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INTRODUCTION

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02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **980**

03 AUXILIARY SYSTEMS
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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **986**

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Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **995**

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Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **1008**

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11 FACILITIES, RESEARCH AND SUPPORT

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Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **1031**

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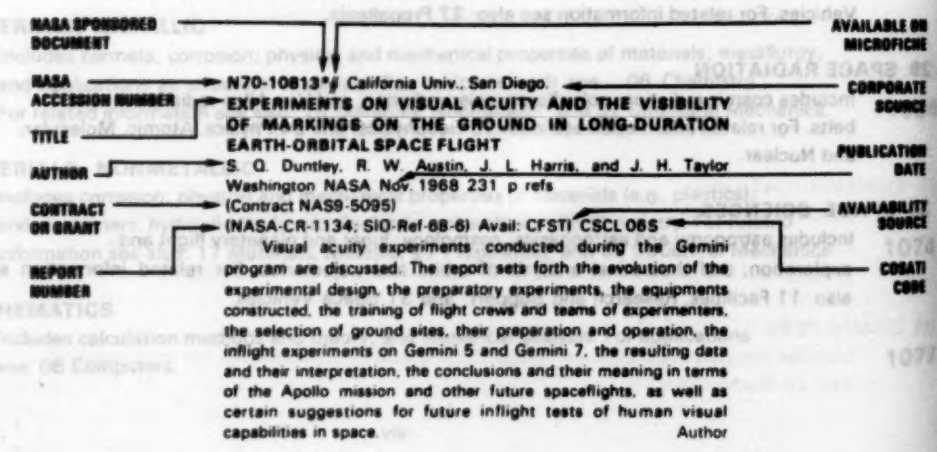
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AUTHOR
S. O. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
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(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-17178# Deutsche Forschungs-und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany) Inst. fuer Flugmechanik.

COMMON TYPES OF AERODYNAMIC DECELERATION EQUIPMENT [DIE GEBRAEUCHLICHSTEN TYPEN VON AERODYNAMISCHEN VERZOEGERUNGSGERAETEN]

O. Muenscher *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 54–64 In GERMAN (See N70-17176 06-02)

Avail: CFSTI

Several parachute types, design, and aerodynamic properties are described. Among those mentioned are flat cap, extended skirt, conical, hemispherical, ring slot, ring sail, and ribbon parachutes. The aerodynamical properties are listed in a table and calculation methods are mentioned. ESRO

N70-17180# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

THE DETERMINATION OF PARACHUTE SNATCH FORCE [DIE BERECHNUNG DER STRECKSTOSSKRAFT VON FALLSCHIRMEN]

P. Schuett *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 74–95 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

A method is given for the approximate calculation of the snatch force occurring in parachute deployment. Drop tests with the extended skirt parachute (T 10) with variable suspension line length were conducted to determine the influence of suspension line length on the snatch force. The results of these measurements are presented. Author (ESRO)

N70-17181# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

CALCULATION OF FILLING TIME AND FILLING DISTANCE FOR CIRCULAR FLAT PARACHUTES [DIE BERECHNUNG DER FUELLUNGSZEIT UND DES FUELLUNGSWEGES FUER EBENE RUNDKAPPENFALLSCHIRME]

P. K. Schmidt *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 96–117 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

A semi empirical method which can be used for the calculation of filling time of circular flat parachutes is described. This method previously used for a horizontal trajectory, is extended to a vertical flying path and based on this, the filling distance for horizontal and vertical trajectories can be calculated. A dimensionless form is used for the determination of filling time and filling distance. The results are given as tables and curves, and some examples are added for illustration. Author (ESRO)

N70-17182# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

CALCULATION OF PARACHUTE OPENING SHOCK [DIE BERECHNUNG DER FUELLUNGSSTOSSKRAFT VON FALLSCHIRMEN]

K. H. Fu *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 118–140 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

Three calculation methods for determining the opening shock in parachute deployment are compared. The effect of the mass, air density, and velocity parameters on the opening shock factor for the circular flat parachute is investigated. The opening forces are calculated not only according to the method given in the Parachute Handbook of the US Air Force but also by using the opening relations given by R. Berndt. Author (ESRO)

N70-17183# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

CALCULATION OF TRAJECTORIES FOR VARIOUS PARACHUTE PAYLOAD SYSTEMS [DIE BERECHNUNG VON FLUGBAHNEN FUER VERSCHIEDENE FALLSCHIRM-LAST-SYSTEME]

C. Saliaris *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 141–170 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

The trajectories for two examples of parachute-load-systems are calculated, and the results are presented in the form of tables and diagrams. The first example deals with various systems of cargo parachute combinations of one, two, or three parachutes (G11 and G12), whereas the second refers to the recovery of a payload from high altitude under the restriction of a low sinking rate. Author (ESRO)

N70-17184# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

STABILITY OF PARACHUTE PAYLOAD SYSTEMS [STABILITAET VON FALLSCHIRM-LAST-SYSTEMEN]

D. Schmerwitz and W. Schmidt *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 171–195 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

Stability problems of parachute-payload-systems are given, and the results from three- and six-component measurements on various types of parachutes are reported and discussed. Types of motion occurring in parachute-payload-systems and recovery systems are explained, and some measures for improving stability are described. Author (ESRO)

N70-17185# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

THE INFLUENCE OF POROSITY ON PERFORMANCE AND PROPERTIES OF PARACHUTES [DER EINFLUSS DER POROSITAET AUF LEISTUNG UND EIGENSCHAFTEN VON FALLSCHIRMEN]

H.-D. Melzig *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 196-211 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)
Avail: CFSTI

The concepts of air permeability and porosity are defined, and the results of air permeability measurements for a variety of cloth at differential pressures from 0 to 500 mm H2O are reported. An empirical formula for the calculation of air permeability at any differential pressure is given. The influence of the porosity of the parachute on canopy shape, filling, opening forces, filling time, and stability is considered, and the influence of air density on the porosity is also discussed. Author (ESRO)

N70-17246# Lockheed Missiles and Space Co., Sunnyvale, Calif.

HYPERSONIC UNSTEADY AERODYNAMICS OF BLUNTED SLENDER CONES AT MODERATE ATTITUDES

Lars Eric Ericsson Oct. 1969 67 p refs
(LMSC-6-R1-69-1) Avail: CFSTI

At hypersonic speeds, the nose-bluntness-induced effects on cone pressure are large. The pressures are well correlated by Cheng's blast wave similarity. Assuming slow oscillations of small amplitude, the perturbation of the pressure distribution due to nose translation can be derived providing the alpha-effect that has to be added to the local perturbation, the q-effect, to provide a correct prediction of the unsteady aerodynamics of blunted cones. For oscillations around a realistic center of gravity (rather than around the nose), the nose-bluntness-induced effects are statically stabilizing, dynamically destabilizing for moderate nose bluntness, and become statically destabilizing, dynamically stabilizing for large bluntness ratios. The predicted static and dynamic stability agree well with available experimental data. Author

N70-17313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AERODYNAMICS OF MARS ENTRY PROBE-LANDER CONFIGURATIONS AT A MACH NUMBER OF 10

Robert I. Sammonds Washington Jan. 1970 57 p refs
(NASA-TN-D-5608; A-3334) Avail: CFSTI CSCL 01A

Five spherically blunted cones were tested in free flight, in still air, to determine their aerodynamic characteristics. Three of these models, by design, had drag coefficients invariant with angle of attack and lift-curve slopes near zero. Each of these three models were statically stable but the dynamic stability was found to depend on cone half-angle and nose bluntness. The lift-curve slopes and dynamic stability of the two high-drag bodies, 55 deg and 60 deg half-angle blunted cones, were invariant with angle of attack and equal in mangitude. These two models were both statically and dynamically stable. Author

N70-17317*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AERODYNAMIC INVESTIGATION OF FOUR-VANE CASCADE DESIGNED FOR TURBINE COOLING STUDIES Technical Memorandum

Herbert J. Gladden, Robert P. Dengler, David G. Evans, and Steven A. Hippensteele Washington Jan. 1970 34 p refs
(NASA-TM-X-1954; E-5294) Avail: CFSTI CSCL 01A

An aerodynamic study was made of an annular sector, four vane cascade designed for cooled turbine thermodynamic studies. Static and total pressures at the vane cascade exit were measured as well as the vane surface static pressures at three radial sections. The vane surface static pressure distribution was of particular interest since it directly affects the determination of vane metal temperatures in later testing. Tests were conducted primarily with low pressure unheated air at vane mean radius exit Mach numbers of 0.73, 0.85 (design), and 0.93. Acceptable aerodyanamic characteristics were found to exist. Author

N70-17432# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.

AN ANALYTIC SOLUTION FOR TWO- AND THREE-DIMENSIONAL WINGS IN GROUND EFFECT

Sheila E. Widnall and Timothy M. Barrows Jun. 1969 30 p refs *Its* Lab. Rept. No. 69-1
Avail: CFSTI

The method of matched asymptotic expansions is applied to the problem of a ram wing of finite span in very close proximity to the ground. The general lifting surface problem is shown to be a direct problem, represented by a source-sink distribution on the upper surface of the wing and wake, with concentrated sources around the leading and side edges plus a separate confined channel flow region under the wing and wake. The two-dimensional flat plate airfoil is examined in detail and results for upper and lower surface pressure distribution and lift coefficient are compared with a numerical solution. A simple analytic solution is obtained for a flat wing with a straight trailing edge which has minimum induced drag. To lowest order, this optimally loaded wing is an elliptical wing with a lift distribution which is linear along the chord. The resultant total spanwise lift distribution is parabolic. An expression for the lift coefficient at small clearance and angle of attack, valid for moderate aspect ratio, is derived. The analytic results are compared with numerical results from lifting surface theory for a wing in ground effect; reasonable agreement is obtained. Author

N70-17458# Southampton Univ. (England). Inst. of Sound and Vibration Research.

THEORETICAL STUDY OF ROTATIONAL NOISE

S. E. Wright May 1969 102 p refs Sponsored by Min. of Technol.
(ISVR-TR-14) Avail: CFSTI

The theory first considers in detail the properties of steady and fluctuating force radiation for point rotating forces. The effect of distributive loading typical of a rotor, both chord and span is then considered. The onset of the nearfield for steady and fluctuating lift radiation is established and the radiation properties within the nearfield discussed. A composite blade loading radiation equation is developed to predict the general radiation from a rotor, and finally a special case is cited to deal with impulsive blade loading radiation similar to that produced by rotor-stator and blade-tip vortex interactions. Author (ESRO)

N70-17608*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

GENERALIZED HOT-GAS INGESTION INVESTIGATION OF LARGE-SCALE JET VTOL FIGHTER-TYPE MODELS

H. Clyde Mc Lemore, Charles C. Smith, Jr., and Patricia G. Hemeter Washington Jan. 1970 153 p refs
(NASA-TN-D-5581) Avail: CFSTI CSCL 01C

An investigation was conducted in the full-scale tunnel on large-scale jet VTOL fighter-type aircraft configurations to study the problem of hot-gas ingestion. The investigation is an extension of an earlier investigation and involves additional test configurations and more sophisticated instrumentation. The investigation includes tests of configurations with several exhaust-nozzle arrangements, inlet positions, and wing positions and sizes for a range nozzle heights from about 1 to 5 effective nozzle diameters above the ground. The tests were conducted for a range of forward speeds from zero to about 35 knots and for side winds from about 8 to 12 knots. Author

N70-17638*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE EFFECTS OF A NONRIGIDLY SUPPORTED BALLAST ON THE DYNAMICS OF A SLENDER BODY DESCENDING THROUGH THE ATMOSPHERE

Gerald N. Malcolm Washington Jan. 1970 18 p refs
(NASA-TN-D-5622) Avail: CFSTI CSCL 01A

The effects of a nonrigidly supported ballast on the dynamic behavior of a slender body with linear aerodynamics descending through the atmosphere in planar motion are investigated. The equations of motion of both the main vehicle and the spring-mounted ballast are derived and specific examples are presented to illustrate the resulting motions. Divergent oscillations of the main vehicle occurred for those conditions near the coalescence of frequency of the main body and ballast motions. Divergence occurred earlier in the flight when spring stiffness was decreased, or when ballast damping was increased for a given spring stiffness. Author

N70-17881# Aircraft Research Association, Ltd., Bedford (England).

RESULTS AND ANALYSIS OF PRESSURE MEASUREMENTS ON TWO ISOLATED SLENDER WINGS AND SLENDER WING-BODY COMBINATIONS AT SUPERSONIC SPEEDS. VOLUME 1: ANALYSIS

K. A. Fellows and C. E. Carter Nov. 1969 52 p refs
(Contract KV/B.541/CB.648)
(ARA-12-Vol-1) Avail: CFSTI

Pressure plotting results on an axisymmetric body and two very slender wings tested in isolation and as wind-body combinations are discussed. The tests which were made in the supersonic wind tunnel were at Mach numbers 1.7, 2.0 and 2.8 and incidence angles from 0 deg to 43 deg. By suitably integrating the pressure coefficients it was possible to isolate the contributions to the overall normal force made by the wing upper surface, wing lower surface, forebody, cylindrical body and the mutual wing-body interference. Each item was compared with theoretical and empirical prediction methods currently available. Significant differences between theory and practice were discovered, particularly for the most slender wing, at high pitch angles. The vortex induced lift on the wing upper surface continues up to very high incidences especially on the most slender wing, with much higher suctions than previously predicted. New values of k, the limiting suction level, are proposed and an empirical formula relating the upper surface normal force to Mach number, leading edge sweep angle and pitch angle is suggested for the range of these particular wings. Body interference on the wing falls off rapidly above about 10 deg to virtually zero at 25 deg incidence. Author

N70-17893 Colorado State Univ., Fort Collins.

WIND DRAG WITHIN A SIMULATED FOREST CANOPY FIELD

George Chia-Lien Hsi (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-5480

An experimental and analytical study of wind drag within simulated forest canopy fields is presented. The drag coefficients, aerodynamic roughness, and wind velocity profiles are studied for various types of forest canopies. A brushy canopy field was studied which simulated the leafy portion of a forest without the tree trunks present. The wind drag force on a single experimental tree was also studied. A shear plate was developed which reliably measures a drag force from 0.1 gram to 2000 grams. The function of this plate was successfully validated by testing it in a turbulent flow over a smooth surface. The drag coefficient of a single model tree, which was the same as those used in the simulated forest canopy fields, was compared with prototype conifers. The work found that a plastic model tree has drag coefficients between those for spruce and Douglas fir trees. Dissert. Abstr.

N70-17948 Texas Univ., Austin.

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE LIFT AND DRAG CHARACTERISTICS OF FLEXIBLE PARAWINGS AT LOW SUBSONIC SPEEDS

Robert Lee Bass, III (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-6111

The evaluation of the experimental data along with the results of the tuft study indicate that the application of finite wing theory is an appropriate approach to predict parawing lift and drag characteristics within the linear lift range of the wing. The analysis proceeds on an assumed parabolic model to describe the parawing canopy shape and thin airfoil theory is used to predict the local angle of zero life based on camber. The resulting twist distribution is introduced into the equations of finite wing theory and the lift and induced drag characteristics are determined for a wide range of parawing configurations at various wing angles of attack. Also, the knowledge of the camber distribution and the local lift coefficient at each section allows the profile drag to be calculated and an integrated average of these local values over the entire wing results in a prediction of the wing profile drag. Dissert. Abstr.

N70-18080*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF PRESSURE DISTRIBUTIONS OF BLUFF TENSION-SHELL SHAPES

James Wayne Sawyer Washington Feb. 1970 40 p refs
(NASA-TN-D-5636; L-6743) Avail: CFSTI CSCL 01A

The accuracy in calculating pressure distributions was improved for various tension shell decelerator shapes and to evaluate the effects on derived shapes resulting from the application of different pressure distributions. Pressure distributions given by Newtonian and integral-relation theory were each used to derive tension shell shapes. Experimental pressure distributions were obtained from two wind-tunnel models. One model shape was derived by using a Newtonian pressure distribution and the other shape was derived by using an integral-relation pressure distribution for a Mach number of 3.0 and were compared with theoretical pressure distributions. The tests were conducted at a Mach number of 3.0, at zero angle of attack, and at a Reynolds number of 10,400,000 based on maximum model diameter. Tension-shell shapes were also derived by using the experimental pressure distributions and were compared with both the Newtonian-derived shape and the integral-relation-derived shape for a Mach number of 3.0. Author

N70-18198*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CALCULATED WIND-TUNNEL-BOUNDARY LIFT-INTERFERENCE FACTORS FOR RECTANGULAR PERFORATED TEST SECTIONS

Benferd L. Schilling and Ray H. Wright Washington Feb. 1970 64 p refs
(NASA-TN-D-5635; L-6832) Avail: CFSTI CSCL 01A

Equations developed and presented for approximating the spanwise distribution of wind-tunnel-boundary interference on lift of wings in rectangular perforated-wall test sections are modified slightly to facilitate machine calculations and are then used to generate extensive tables of interference factors for a variety of wind-tunnel and wing parameters. Data are presented for horseshoe vortex representations of small-span and large-span wings mounted at the center of rectangular test sections with five values of tunnel width-height ratio varying from 0.5 to 2.0 and with the ratio of permeability factor to compressibility factor ranging from 0.1 to 25.0. Spanwise distributions of upwash interference factor are given for each case. Use of the tables requires knowledge of the values of permeability factor applicable to the perforated test section for which lift interference factors are desired. Machine computer programs used in the calculations are presented as an appendix. Author

N70-18243*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REVIEW OF PROPULSION-INDUCED EFFECTS ON

AERODYNAMICS OF JET V/STOL AIRCRAFT
Richard J. Margason Washington Feb. 1970 69 p refs presented at Tenn. Univ. Space Inst. Short Course on V/STOL, Knoxville, Tenn., Nov. 1968
(NASA-TN-D-5617; L-6565) Avail: CFSTI CSCL 01A

Several aspects of the effects induced on the aerodynamics of V/STOL aircraft are reviewed in hover and transition flight by the interference of wakes from relatively high disk-loading propulsion devices. Four problem areas are treated. (1) the performance losses sustained when hovering out of ground effect, (2) induced aerodynamic effects in transition flight out of ground effect, (3) the problems caused by hot gas ingestion, and (4) the effects induced on performance during hover in ground effect. Some of the conflicts among the design requirements imposed by these different modes of flight are discussed, along with the present state of the art of solutions to some of the problems. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-16973# Boeing Co., Seattle, Wash.
AUTOMATIC FLIGHT MANAGEMENT OF FUTURE HIGH-PERFORMANCE AIRCRAFT
David M. Petrie *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 10 p (See N70-16962 06-07)
Avail: CFSTI

The integrated flight management system described herein employs a central computer onboard the aircraft to 1) control flightpath segments to precisely follow a flexibly programmed space-time profile; 2) effect configuration control of the airplane and its principal subsystems; 3) automate the preflight checklist and equipment switching; 4) drive a multimode cathode ray tube display for monitoring equipment status and navigational situations; 5) effect automatic placarding for semiannual modes of flight operations; and 6) compute Mach number, effect cg control, store and display emergency operating procedures, and perform other similar functions that are amenable to centralized computing. Manual reversion for all automated functions is available. A similar increase in computerization of the air traffic control system is needed to best exploit the precise navigation and control capabilities of the automatic flight management (AFM) airplane in improving traffic flow and airport utilization. Author

N70-16974# Autonetics, Downey, Calif.
OPERATIONAL ASPECTS OF ADVANCED AVIONIC CONTROL AND DISPLAY SYSTEMS
Richard K. Smyth and Kenneth G. Conner *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 12 p (See N70-16962 06-07)
Avail: CFSTI

Mission analysis and simulation studies, together with creative avionic systems engineering and human factors engineering, aid in the optimization of the man-machine interface. It is necessary during the design evolution, however, that the design be evaluated frequently by operationally oriented aircrews with real world experience to assure success in the optimization. Author

N70-16980# Federal Aviation Administration, Atlantic City, N.J. Dept. of Transportation.
EVALUATION OF TAXIWAY GUIDANCE SIGNS Interim Report
Robert F. Gates and Cecil B. Phillips Jan. 1970 36 p
(FAA-NA-70-9; RD-69-60) Avail: CFSTI

Taxiway guidance signs, 3 feet high and 4 feet wide of a type similar to those used on highways, were evaluated for airport use by means of simulation and actual field trials. Retro-reflective sheeting of red, yellow, and green colors was evaluated for color coding application in a taxiway guidance system. Legends, 18 inches in height, were prepared from white enamel and silver retro-reflective sheeting on a red background, black paint on a yellow background and white enamel on a green background. Retro-reflective discs also were used on the legends for the red and green signs. The discs provided excellent long-range targets but legibility deteriorated as the signs were viewed at distances of 500 to 600 feet and less due to the increased angle from the aircraft light to the sign and the pilot eye, coupled with the white paint appearing black to the observer at these ranges. Author

N70-16991# RAND Corp., Santa Monica, Calif.
CAAC: THE AIRLINE OF COMMUNIST CHINA
Harriett E. Porch Sep. 1969 20 p refs Presented at 6th Ann. Meeting of the Am. Inst. of Aeron. and Astronaut., Anaheim, Calif., 20 Oct. 1969 Submitted for publication
(AD-693926; P-4184) Avail: CFSTI CSCL 1/2

The status of civil aviation in Communist China is assessed. Present airline operations in China consist of fewer than 300 planes providing scheduled service to 80 cities. A table showing the growth in service is presented, and it is noted that while the growth has been steady, it has not been spectacular. It is further concluded that with only four scheduled international routes, Communist China is unlikely to become a major competitor in world aviation in the near future. D.L.G.

N70-17135# Optics Technology, Inc., Palo Alto, Calif.
FIBER OPTICS HAZARD IDENTIFICATION DEVICE Final Technical Report, 17 Jan. 1966 – 30 Apr. 1969
Brian G. Phillips Oct. 1969 54 p
(Contract AF 33(615)-3532)
(AD-697036; AFAPL-TR-69-78; Rept-11014R) Avail: CFSTI CSCL 1/3

This report describes the work done over a period of three years to develop a fiber optics fire hazard detection system for aircraft installation. The distal end of this system which is located within the engine compartment is capable of withstanding temperatures of 1000F, whereas the rest of the system is capable of withstanding temperatures to 500F. During the course of the program, a number of fabrication techniques were developed and high transmittance glasses were evaluated for transmission and strength. In addition to this work, a fire simulator was developed, and this may be mounted within the engine compartment. Author (TAB)

N70-17176# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
PARACHUTE ENGINEERING AND RECOVERY SYSTEMS [FALLSCHIRMTECHNIK UND BERGUNGSSYSTEME]
Hans-Dietrich Melzig, ed. Sep. 1969 406 p refs In GERMAN; ENGLISH summaries Proc. of the DGLR-DFVLR-AGARD Symp., Brunswick, 15 – 19 Sep. 1969
(DLR-MITT-69-11) Avail: CFSTI

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17. TEST METHODS AND MEASUREMENT TECHNIQUES FOR PARACHUTES H.-J. Klewe p 394 - 406 refs (See N70-17192 06-02)

N70-17177# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

DEFINITIONS [DEFINITIONEN]

H.-D. Melzig *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 48 - 53 In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

No standards are available in parachute engineering for symbols, notations, technical terms, and definitions of quantities and notions. Symbols are proposed and the notation used in this publication, and the technical terms are explained. The definitions of the most important quantities occurring in parachute engineering are also presented. Author (ESRO)

N70-17179# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

PARACHUTE DESIGN CRITERIA [RICHTLINIEN FUER DIE AUSLEGUNG VON FALLSCHIRMEN]

H.-D. Melzig *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 65 - 73 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

A survey is given of the essential aspects to be considered in designing parachutes. Drag coefficients of the most usual parachute types are tabulated, general criteria are given for the selection of the deployment system, and the calculation methods are explained. Author (ESRO)

N70-17186# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

PARACHUTE MATERIALS [FALLSCHIRMWERKSTOFFE]

H.-J. Seifert *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 214 - 287 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

A survey is given of parachute textile fabrics of German design which are listed in specification sheets. The production and fabrication of natural and synthetic fibers, their physical and chemical properties, their processing into threads and yarns as well as the structure and manufacture of various textile semifabrics are described. Various methods for testing the mechanical properties of parachute textile fabrics are also outlined. Author (ESRO)

N70-17187# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

PARACHUTE HARDWARE [BESCHLAGTEILE IN DER FALLSCHIRMTECHNIK]

D. Muenscher and P. Hoenen *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 288 - 309 In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

A German-English glossary of terms used to describe parachute hardware is presented. Author (ESRO)

N70-17189# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

SAFETY AND DESIGN FACTORS IN PARACHUTE ENGINEERING [SICHERHEITS- UND KONSTRUKTIONSFAKTOREN IN DER FALLSCHIRMTECHNIK]

H.-D. Melzig *In its* Parachute Eng. and Recovery Systems Sep 1969 p 353 - 358 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

Safety factors for different applications of parachutes are given which are specified or recommended for their strength. Values for design factors are given, which allow the parachute designer to consider various influences which diminish parachute strength. Author (ESRO)

N70-17190# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

DESIGN AND PERFORMANCE DATA OF SOME SOLID CLOTH TYPE PARACHUTES [KONSTRUKTIONS- UND LEISTUNGSWERTE EINIGER BREITGEWEBEFALLSCHIRME]

R. Koch and H. Pollnow *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 359 - 371 ref In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

The design of the three most frequently used solid cloth type parachutes (circular flat-, extended skirt-, and hemispherical) is described, and design details are given. Performance values from measurements for the snatch force, the opening shock force, and the filling time are listed in tables and plotted in diagrams. For some cases, the total force distribution is shown. Author (ESRO)

N70-17191# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

REQUIREMENTS FOR EJECTION SEAT SYSTEMS [ANFORDERUNGEN AN SCHLEUDERSITZSYSTEME]

U. Schmidt *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 372 - 393 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

The requirements for ejection seat systems are outlined and discussed by considering some extreme flight positions, given by flow velocity, altitude, attitude, and sink rate parameters. The limits of physiological and functional nature are demonstrated, and proposals to extend the performance range of rescue systems are given. Author (ESRO)

N70-17192# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

TEST METHODS AND MEASUREMENT TECHNIQUES FOR PARACHUTES [VERSUCHSMETHODEN UND MESSTECHNIK BEI FALLSCHIRMVERSUCHEN]

H-J. Klewe *In its* Parachute Eng. and Recovery Systems Sep. 1969 p 394-406 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)

Avail: CFSTI

To achieve measurements with parachutes under free atmospheric conditions, a special test vehicle range was developed by the Department for Parachutes and Recovery Systems of the DFVLR in Braunschweig (Germany). The operational behavior and the experimental testing of one such test vehicle are described. Author (ESRO)

N70-17231# Weapons Research Establishment, Adelaide (Australia).

INVESTIGATION OF ACCIDENT TO UMK.21 METEOR TARGET AIRCRAFT A77-802

D. S. Kerr Oct. 1969 6 p

(WRE-TM-WSD-144) Avail: CFSTI

Outlined are the details of an accident to the unmanned Meteor aircraft A77-802. This accident occurred during takeoff on the 21 Aug. 1969, under conditions of variable winds of velocity less than 5 knots. The results of an investigation are presented, together with the necessary recommendations to enable detection during the pre-takeoff checks, of the type of defect responsible for the accident. Author

N70-17315# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONSTRUCTION OF CIRCUITS OF AUTOMATIC SIGNAL INDICATORS OF FLOW CONDITIONS BASED ON A MEASUREMENT OF PRESSURE DISTRIBUTION ALONG THE STREAMLINE SURFACE

A. M. Mkhitaryan et al 14 Feb. 1968 14 p Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota (USSR), no. 10, 1967 p 47-52

(AD-696610; FTD-MT-24-397-68) Avail: CFSTI CSCL 1/4

An instrument developed for indicating the bread-away of streamline flow from aircraft surfaces, based on the pressure distribution along the streamline surface, is precise and reliable. The pressure receivers form metal caps over air holes positioned along the wing. These caps extend 3-5 mm above the wing surface and do not disturb the flow. The pressure signal of the air is fed through tubes to pressure sensors connected to two adjacent receivers. These sensors measure the pressure difference between them in the range -100 to +200 mm of water, sending continuous electric signals to a semiconductor relay set to trigger at a specific voltage corresponding to a specific pressure differential between receivers. With bread-away of the streamline flow, the relay is triggered and lights an indicator so that the number of lighted indicators shows the wing area covered by the bread-away. The relay signal is also fed to a diode coincidence circuit which warns of stalling and also directs the control system for stabilizing the boundary layer flow. The instrument can be used in helicopter rotor blades. Author (TAB)

N70-17630*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN ANALYSIS OF VGH DATA COLLECTED FROM ONE TYPE OF FOUR-ENGINE TURBOJET TRANSPORT AIRPLANE

Paul A. Hunter and Mary W. Fetner Washington Jan. 1970 37 p refs

(NASA-TN-D-5601) Avail: CFSTI CSCL 01C

Data are presented on incremental normal accelerations due to gusts, maneuvers, oscillations, landing impacts, and ground operations; on derived gust velocities; and on airspeed operating practices. These data were obtained from NASA VGH recorders installed on two identical four-engine turbojet transport airplanes flown by a single airline. The airline route structure consisted primarily of routes covering the eastern half of the United States, although a few flights were also made to the west coast and to northern South America. Author

N70-17656*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INFLUENCE OF HIGH TURBINE-INLET TEMPERATURE AND TAKEOFF JET NOISE ON A METHANE-FUELED SUPERSONIC TRANSPORT WITH VARIABLE-SWEEP WINGS

Gerald A. Kraft Washington Jan. 1970 17 p refs

(NASA-TM-X-1940) Avail: CFSTI CSCL 01C

The benefits of high-turbine-inlet-temperature engines and the reduction of community noise levels by the use of a variable-sweep-wing SST were analyzed. Three optimized engine types, the afterburning turbojet, and the duct-burning turbofan, were compared using methane fuel. Without noise constraints, the afterburning turbojet and the duct-burning turbofan yielded the best payload. With noise constraints, only the duct-burning turbofan maintained reasonable payload. Oversized engines and the excellent low-speed aerodynamics of the variable sweep-wing design resulted in less community noise than a fixed-wing design used in another study. Author

N70-17959# College of Aeronautics, Cranfield (England).

THE HEAVE STABILITY OF AN AIR CUSHION VEHICLE WITH A FLEXIBLE PERIPHERAL SKIRT

J. Spillman Aug. 1969 10 p

(COA-AERO-210) Avail: CFSTI

Factors that cause air cushion vehicles with flexible skirts to suffer from a violent instability in heave are analyzed. An equation of motion describing the perturbation heave motion about an equilibrium position is expanded and conditions effecting the balance of forces are determined. Findings indicate: (1) A plenum chamber type air cushion vehicle with an impervious flexible skirt is subject to instability in heave unless the supply rate and cushion pressure are very small. (2) Heave stability can be obtained by using a porous skirt with porosity dependent upon the sensitivity of the air control valve and the magnitude of the likely disturbances. (3) The smaller the pumping effect of transversing an irregular surface and the greater the control valve sensitivity the smaller will be the porosity required of the skirt and the lower the power required for hovering. A description of a skirt that may provide adequate stability in heave is included. D.L.G.

N70-18035*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

LOCAL FLOW FIELD AROUND A PYLON-MOUNTED DUMMY RAMJET ENGINE ON THE X-15-2 AIRPLANE FOR MACH NUMBERS FROM 2.0 TO 6.7

Frank W. Burcham, Jr. and Jack Nugent Washington Feb. 1970 58 p refs

(NASA-TN-D-5638; H-566) Avail: CFSTI CSCL 01C

The flow field around a pylon-mounted dummy ramjet engine on the X-15-2 airplane was surveyed at Mach numbers from 2.0 to 6.7 in preparation for flight tests of a hydrogen-burning hypersonic ramjet engine. Impact pressures, local Mach number, and flow angularity were determined and compared with wind tunnel data and theoretical calculations. The wing, camera fairing, and side fairing of the X-15-2 generated shock waves which impinged on the dummy ramjet and pylon. However, a region free of significant shock wave impingement on the ramjet inlet existed for flight at a free stream angle of attack of 5 deg or less for free stream Mach numbers from 3.0 to 6.0. In flight regions free of shock wave impingement, impact pressure, local Mach number, and angle of attack generally showed good agreement with wind tunnel data. Shock wave locations determined from impact-pressure data and wind tunnel schlieren photograph data showed good agreement. Strong flow interference effects occurred at the

pylong-fuselage intersection. The separated flow region and the resulting separation shock wave remained within 10 inches (25.4 centimeters) of the fuselage surface in front of the pylon for all flight conditions. The extent of separated flow was sensitive to angle of attack and extremely sensitive to small deviations from 0 deg in angle of sideslip. Author

N70-18036*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF LATERAL-DIRECTIONAL DYNAMIC STABILITY OF A TILT-WING V/STOL TRANSPORT
Joseph R. Chambers and Sue B. Grafton Washington Feb. 1970 53 p refs
(NASA-TN-D-5637; L-6848) Avail: CFSTI CSCL 01C

The investigation consisted of (1) static and dynamic force tests with a powered model to measure stability derivatives, (2) calculations of the lateral-directional dynamic stability characteristics, and (3) comparison of the calculated characteristics with current handling quality requirements for dynamic stability characteristics. The results indicated that the configuration would exhibit an unstable lateral-directional oscillation at low speeds. The dynamic stability characteristics of the basic airplane did not satisfy the handling quality requirements for wing-incidence angles greater than 30 degrees. The vehicle exhibited satisfactory characteristics when artificial stabilization was incorporated into the design. Author

N70-18041# Coast Guard, Baltimore, Md. Field Testing and Development Center.
HELICOPTER EMERGENCY EXIT LIGHTING Test Report
G. P. Clark 3 Nov. 1969 44 p
(AD-696563; USCG-498) Avail: CFSTI CSCL 1/3

Four potential systems of emergency exit lighting were tested. One system used RF-excited fluorescent lights, one used a chemiluminescent material, and the other two systems employed electroluminescent tapes. Luminous output of each was measured as a function of operating time on batteries, and subjective underwater tests were made in a mockup HH52A helicopter cabin. The systems are comparatively evaluated, and recommendations of requirements and specifications for a usable system, based upon the knowledge produced by this project are given. From the results of these tests it appears that electroluminescent materials offer the most promise. Author (TAB)

N70-18182 Rensselaer Polytechnic Inst., Troy, N.Y.
THEORETICAL DEVELOPMENT OF AN OPTIMUM AIRCRAFT CONTROL SYSTEM
Charles Joseph Greaves (Ph. D. Thesis) 1968 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-8461

The development of an improved control system for controlling the longitudinal motion of an aircraft in a low altitude flight mode is described. Firstly, the development of an ideal aircraft flight path is considered. The formulation of this ideal flight path is made in such a manner that the flight path is conceptually meaningful from an engineering point of view. In addition, the ideal flight path which is formulated is capable of being generated rapidly so that it becomes feasible to use this flight path in the real time control of low flying aircraft. The second area of investigation concerns the development of an optimum controller for low flying aircraft based upon inflight computations of the ideal aircraft flight path. The aircraft controller gains are obtained by minimizing a quadratic performance index. The index selected includes, in addition to initial and terminal error expressions, an integral of a quadratic error measure over an interval of time which is considerably shorter than the total operating time of the system. Dissert. Abstr.

N70-18269# Advisory Group for Aerospace Research and Development, Paris (France).
AIRCRAFT ENGINE NOISE AND SONIC BOOM
W. R. Sears Jan. 1970 8 p refs
(AGARD-22) Avail: CFSTI

The scientific and technical content of a conference on engine noise and sonic boom is evaluated and assessed. A review was given of the physics of noise production and propagation, emphasizing that aerodynamic noise and sonic boom have much in common. Except for noise due to turbulence, it is concluded that the basic physics for engine noise and sonic boom is already available. The theory and methods of alleviating sonic boom were discussed. R.B.

N70-18261# United Control Corp., South El Monte, Calif. Data Div.
PARAMETRIC STUDY OF THERMAL PROTECTION CONCEPTS FOR AIRBORNE RECORDED TAPES IN A SEVERE CRASH ENVIRONMENT Final Report
Richard B. Hulett Sep. 1969 101 p refs
(Contract FA-68-WA-1998)
(DS-69-11) Avail: CFSTI

Concepts are investigated and recommendations are made for lengthening the fire survival capability of airborne magnetic tape crash recorders. The internal recorder temperature for one, two, and six sided heating is studied analytically. Commercially available and experimental insulations are reviewed and evaluated. Using one and two layer walls of the more promising insulations, the internal temperatures achieved through internal heating from the normal operation of the recorder and the transient temperatures achieved during and after the crash environment were calculated by computer. A detailed description is given of the analytical methods used in computing the thermal performance. Recommendations are made concerning the type of materials to be used for the wall structures. Author

N70-18283# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
ACCELERATED TESTING OF GENERAL AVIATION ENGINE EXHAUST SYSTEMS Final Report
Gerald Slusher Feb. 1970 39 p refs
(FAA-NA-70-23; FAA-DS-70-2) Avail: CFSTI

An accelerated test procedure was developed for possible use to enhance and demonstrate the airworthiness of exhaust systems of single-engine aircraft incorporating exhaust gas-to-air heat exchangers. The exhaust systems of seven aircraft were endurance tested on engine stands to determine if the types and times of failures occurring during the tests were similar to failures occurring in aircraft and to identify design features for minimizing hazards. Evaluation of an exhaust system fabricated of a more corrosion-resistant material was included. Testing was conducted either until failure occurred or 600 test hours were accumulated. The accelerated test schedule and procedure produced failures comparable to those occurring in aircraft with 1 hour of testing equivalent on the average to 3.8 hours of operation in aircraft. It was concluded that the utilization of more corrosion-resistant, nickel-iron-chromium material would significantly reduce or eliminate those exhaust system failures resulting from high temperature oxidation or corrosion, and that muffler failures and related carbon monoxide hazards could be minimized by the design and construction of airtight cabin ventilating systems in conjunction with the incorporation of muffler designs of the axial flow through type fabricated of a more corrosion-resistant material. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-17022# Leesona Corp., Great Neck, N.Y.
THE 25- AND 40-AMPERE HOUR ANODE/ELECTROLYTE COMPOSITE PRODUCTION PROGRAM Final Report, Jan. 1968 - Feb. 1969

Robert Romeo and Joseph Delfino Fort Monmouth, N.J. ECOM Oct. 1969 20 p
(Contract DAAB07-68-C-0173)
(AD-696790; ECOM-0173-F) Avail: CFSTI CSCL 10/3

The production and testing of 25 AH and 48 AH anode/electrolyte composites is the subject of the report. A total of 30,000 composites were produced. The composites conformed to Electronics Command Development Description EL-CP2000-0028C, dated 27 October 1967. The batch process method of manufacture was used in the production of the composites. The batch size was 48, and based on statistical analysis it was indicated that performance characteristics could be established by sampling three composites from each batch. The production schedule established permitted the gradual upgrade in performance to the required level. Statistical analysis of extensive single cell test data indicated that the required performance characteristics could be established with a confidence level of over 99%. A description of the Quality Assurance program employed and the shipping log of the 30,000 anode/electrolyte composites are included in the report. Author (TAB)

N70-17067# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE PROBLEM OF CORRECTING TWISTED TURBINE BLADES
I. G. Gogolev et al 24 Mar. 1969 13 p refs Transl. into ENGLISH from Iz. Vyssh. Ucheb. Zaved., Energ. (Minsk), no. 9, 1967 p 62-67
(AD-696602; FTD-HT-23-867-68) Avail: CFSTI CSCL 10/1

A series of studies on steam and gas turbines with blades twisted according to a specific relationship were tested at a given blade aspect ratio. Some of the models were made with shrouded and shroudless rotor blades and with a sealing ring, and in some cases, cylindrical guide vanes were used. The investigation results for some stages are plotted using graphs to represent the variation in the experimental and calculated values of the degree of reaction and angle at various ratios. This distribution of the parameters along the blade height is caused mainly by the secondary flow and the overflow of the working substance in the axial and radial clearances near the transverse flow boundary. Consequently, negative angles of attack are created near the blade root, and positive angles are created at the periphery. These angles of attack increase the stage energy losses and reduce its efficiency. Improper angles of attack can reduce stage efficiency by approximately 0.5 percent. The relation of the degree of reaction and the angles of attack is shown in the appropriate figure in the text. The rotor blade correction method is discussed. TAB

N70-17194# Selenia S. P. A., Rome (Italy).
PAS TRANSFER ORBIT SOLAR CELL ENERGY AS FUNCTION OF LAUNCH TIME
Gerard Wiegam 3 Aug. 1967 15 p Sponsored by ELDO
(Rept-RT-67/523) Avail: CFSTI

Solar radiation is converted into electric power by the solar cells on the surface of the PAS satellite. The angle of incidence of the solar flux and eventual eclipses by the earth's shadow determine the amount of resulting electric energy. The transfer orbit being defined and prescribed completely; the only variable is the time of launch. The accumulated electric energy per orbit of transfer for eighty different launch times is given. Also included are the eclipse times for these different launchings and the FORTRAN 4 program developed for the Univac 1218. For PAS launchings between 4 and 10 a.m. or p.m. local time (Kourou), the electric power generated by the solar cell plant during the transfer phase is more than sixty percent of the maximum possible. Best time of launch is 7 a.m. and 7 p.m. Worst time of launch is 1 a.m. and 1 p.m. and the worst months of launch are March and September. Author (ESRO)

N70-17258# Army Electronics Command, Fort Monmouth, N.J.
SIMPLIFIED HYDRAZINE-AIR FUEL CELL SYSTEM
John Perry, Jr. Sep. 1969 23 p refs
(AD-697113; ECOM-3175) Avail: CFSTI CSCL 10/2

A significant approach toward simplifying the manpack hydrazine-air fuel cell is the use of hydrazine-air bicells. Hydrazine-air bicells are capable of operating at high fuel concentrations and have inherent electrolyte circulation which eliminates the use of electrolyte pumps. Techniques for the fabrication of a simplified hydrazine fuel cell system using bicells and modular auxiliary components are outlined. The capability of simple unit exchange significantly extends the life of the system. Optimization of the bicell design and the modular concept will lead to the development of more reliable, more durable and less costly manpack power sources. Author (TAB)

N70-17297*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PHOSPHORUS DIFFUSION CONDITIONS FOR SHALLOW-JUNCTION SOLAR CELLS
Harold E. Kautz Washington Jan. 1970 26 p refs
(NASA-TN-D-5629; E-5341) Avail: CFSTI CSCL 10B

Response to 0.4-micrometer light and fill factor of shallow-junction n-on-p silicon solar cells was measured. Diffusion time, temperature, phosphorus source, and carrier gas were varied. The 0.4-micrometer response increased with decreasing junction depth measured in terms of sheet conductance. For a sheet conductance less than .005 square/ohm, 0.4-micrometer response and fill factor degraded with increased reverse leakage. The sources P2O5 and POCl3 yielded more reproducible results than did elemental phosphorus. The P2O5 results were superior to POCl3 results at 800 C but were equivalent up to 1000 C. Oxygen, nitrogen, and forming gas carriers yielded essentially equivalent results with constant sheet conductance. Author

N70-17299*# TRW Systems Group, Redondo Beach, Calif.
STUDY AND DETERMINATION OF AN OPTIMUM DESIGN FOR SPACE UTILIZED LITHIUM DOPED SOLAR CELLS Quarterly Report
R. G. Downing 15 Jan. 1970 43 p Prepared for JPL
(Contracts NAS7-100; JPL-952554)
(NASA-CR-107861; TRW-13154-6006-R0-00; QR-2) Avail: CFSTI CSCL 10B

A study of the kinetics of lithium-doped silicon under the influence of electron radiation utilizing Hall coefficient and capacitance measurements on both crucible and float-zone silicon has yielded considerable information. In crucible silicon electron radiation results principally in the formation of silicon A center recombination sites. Subsequent recovery appears to occur by annihilation of the A center through lithium diffusion and interaction. In float-zone silicon, carrier removal rates during irradiation were found to be a strong function of lithium concentration and hence distance from the barrier edge. Removal rates in float-zone silicon during recovery exceed by a significant amount the removal rate during irradiation as contrasted to crucible silicon. The solar cell evaluation of recent groups of lithium-doped solar cells indicate negative results in that the recent groups tested are inferior to the better groups previously tested. Diffusion of oxygen into float-zone silicon and diffusion of lithium from both sides do not appear at this time to enhance the initial and recovery characteristics of lithium-doped cells. Author

N70-17307# Tyco Labs., Inc., Waltham, Mass.
HIGH ENERGY BATTERY SYSTEMS BASED ON PROPYLENE CARBONATE
Raymond Jasinski Jul. 1969 114 p refs
(Contract F19628-68-C-0052)
(AD-697037; AFCRL-69-0381; SR-2) Avail: CFSTI CSCL 10/3

The electrochemistry of electrolyte and electrode systems based on the aprotic organic solvent propylene carbonate is reviewed with emphasis on the application of such systems to high energy batteries. Topics discussed include electrolyte stability, purity requirements, purification procedures, solvent-ion interaction phenomena, and electrode reactions of inorganic positives, organic

positives, and active metal negatives. Performance of primary battery systems is satisfactory for many purposes. The development of secondary systems and systems for operation at low temperature is discussed. Author (TAB)

N70-17439# Selenia S. P. A., Rome (Italy).
SOLAR GENERATOR FOR ELDO F/9 [ALIMENTATORE SOLARE PER ELDO F/9]
F. Di Mauro 29 Jul. 1968 29 p In ITALIAN Sponsored by ELDO
(Rept-RT-68/719) Avail: CFSTI
This report concerns a study for determining the position of solar cell panels on the external satellite panels taking into account the specified power requirements (38 to 40W) and the effects of the antenna shadows. Author (ESRO)

N70-17452# Institute of Nuclear Research, Warsaw (Poland).
TIME RESPONSE OF THE RADIATION ELECTROCHEMICAL CELL
Zbigniew Zimek and Zbigniew P. Zagorski 1968 18 p In POLISH
(INR-994) Avail: AEC Depository Libraries
The approximate equivalent circuit of the electrochemical cell converting energy of ionizing radiation into electric current was established and its time characteristics calculated. On this basis, the possibilities of the cell as a sensor of short pulse of ionizing irradiation were analyzed, and the influence of cell parameters on the quality of measurements is discussed. Author (NSA)

N70-17464*# Heliotek, Sylmar, Calif.
DEVELOPMENT OF AN INTEGRATED LIGHTWEIGHT FLEXIBLE SILICON SOLAR CELL ARRAY Quarterly Technical Report, 1 Oct. 1969 – 1 Jan. 1970
E. L. Ralph, E. F. Zimmerman, and P. M. Stella 1 Jan. 1970 40 p Prepared for JPL
(Contracts NAS7-100; JPL-952560)
(NASA-CR-107872; QTR-2) Avail: CFSTI CSCL 10B
This document reports technical progress in a program to develop an Integrated Lightweight Flexible Silicon Solar Cell Array. The purpose of the program is to develop design data which will contribute to reduced cost and weight characteristics for lightweight, flexible solar cell arrays. Included are: (1) cost effectiveness comparison of solar cell coverglasses, (2) detailed analysis of solar cell interconnect thermal stresses, and (3) analysis of interconnector and array substrate materials. Author

N70-17466*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
HYDRAZINE ELECTROLYSIS CELL SAFETY LIMITS TESTS Summary Report, 1 Apr. – 29 May 1969
N. E. Morgan 3 Jun. 1969 47 p ref Prepared for JPL
(Contracts NAS7-100; JPL-951720)
(NASA-CR-107867) Avail: CFSTI CSCL 10B
The work reported is a continuation of a previous program of testing an experimental hydrazine electrolysis cell. The purpose of this program was to investigate the performance of the electrolysis cell at extreme conditions of voltage, current, and temperature to determine if any controllability problems existed. Early in the planned test program a failure which destroyed the electrolysis cell was experienced. The subsequent failure investigation indicated that the probable cause was thermal decomposition due to local hot spot on the cathode screen. Author

N70-17559# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
HELIUM TURBINES WITHOUT RECUPERATORS [HELIUMTURBINEN OHNE REKUPERATOREN]
H. U. Frutschi May 1969 9 p refs In GERMAN
(EIR-156) Avail: AEC Depository Libraries
A study was made to determine the cycle efficiencies and power outputs that could be attained with simple helium turbines without recuperators. The construction possibilities indicated by the results of the analysis were considered. Cycles without either an intermediate cooler or a recuperator and cycles with an intermediate cooler but without a recuperator were analyzed. A compact installation for a 1000 Mw(e) plant is described. NSA

N70-17564*# Texas Technological Coll., Lubbock. Dept. of Geosciences.
MARTIAN ENVIRONMENTAL EFFECTS ON SOLAR CELLS AND SOLAR CELL COVER GLASSES Quarterly Report
F. Alton Wade 15 Jan. 1970 17 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952582)
(NASA-CR-107873; TTU-3301; QR-2) Avail: CFSTI CSCL 10B
The progress of the work on the project entitled Martian Environmental Effects on Solar Cells and Solar Cell Cover Glasses is reported. The possibility of dust storms on Mars is recognized as is the possibility of detrimental effects of dust storms to any solar cell array placed at or near the surface of Mars. Solar cells will be subjected to dust storms in wind tunnels where simulated Martian environmental conditions prevail. The electrical performance of the solar cells will be tested before and after each test and the damage to the cells will be assessed. A description of the wind tunnel in which experiments at ambient temperatures are performed is presented. Author

N70-17621# European Space Research and Technology Center, Noordwijk (Netherlands).
POWER SYSTEMS IN ESRO SATELLITES
A. W. Preukschat Jul. 1969 22 p Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-TN-83) Avail: CFSTI
The requirements and general design of a power system that uses solar cells as power source are discussed. Detailed summaries are given of the design of the power systems in the ESRO satellites ESRO 1, ESRO 2, and HEOS A, with a description of some of the units. Author (ESRO)

N70-17763*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL RESULTS OF VARYING THE BLADE-SHROUD CLEARANCE IN A 6.02-INCH RADIAL-INFLOW TURBINE
Samuel M. Futral, Jr. and Donald E. Holeski Washington Jan. 1970 24 p refs
(NASA-TN-D-5513; E-5226) Avail: CFSTI CSCL 10B
Results are reported in terms of efficiency, mass flow rate, and turbine exit conditions. Clearances were varied from 0.25 to 7 percent of passage height at the rotor entrance and rotor exit. Graphs are presented for separating the effects of clearance variations at the rotor entrance from these at the rotor exit. Author

N70-17956 Washington Univ., Seattle.
THE CONVERSION OF LINEAR OSCILLATORY MOTION TO ELECTRICAL ENERGY
Milton Dharl Mobley (Ph.D. Thesis) 1968 116 p refs
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-7069
The characteristics of a flux switching device and a moving field device to convert oscillatory motion to electrical energy were determined. A variable reluctance device is analyzed and the output voltage as a function of input motion is derived. The output voltage and internal impedance for both saturated and nonsaturated switching is derived for any form of linear displacement motion. The excitation current requirements, self excitation, power output, driving force and some general considerations in the design are discussed. A moving field device is described and the open circuit output voltage for a single turn coil is derived. The output voltage wave shapes for input motion and moving fields are discussed. The energy relations are examined and an analog derived from generalized rotating machine equations to substantiate the energy relations determined. The construction of a moving field device

using a permanent magnet rotor structure is discussed and the principal relations of permanent field distribution to output voltage derived. Dissert. Abstr.

N70-18018*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURRENT DENSITY MAPPING OF CADMIUM SULFIDE THIN-FILM SOLAR CELLS
Robert M. Masters and Francis J. Stenger Washington Jan. 1970 11 p refs
(NASA-TM-X-1938; E-5365) Avail: CFSTI CSCL 10B

A diagnostic technique was developed to examine CdS thin film solar cells and rapidly determine the location of current nonuniformities. This was accomplished by measurement of the magnetic field normal to the solar cell. The results are displayed in a graphic form allowing visual location of nonuniform regions. Author

N70-18037*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF INLET-GUIDE-VANE CONFIGURATION AND RELATIVE BLADE VELOCITY ON NOISE FROM AXIAL-FLOW COMPRESSORS
David Chestnutt and Lorenzo R. Clark Washington Feb. 1970 27 p refs
(NASA-TN-D-5507; L-6352) Avail: CFSTI CSCL 13G

Studies on the effects of change of relative blade velocity, pressure ratio, inlet-guide vane choking, and the spacing of the inlet guide vanes and rotor have been made with a specially designed axial flow research compressor. A three stage transonic compressor configuration and a single stage subsonic compressor configuration were used in this investigation. Experimental data are presented which indicate that pressure ratio is the dominant parameter in compressor noise production. Relative blade velocities were found to be important but to a lesser degree. Rotational speed, in itself, was found to be independent of noise production. Choking of the airflow in the inlet guide vanes of the transonic compressor resulted in overall noise reduction of 25 to 30 dB at compressor speeds as low as 72 percent of design rpm. Increasing the axial spacing of the inlet guide vanes on the three stage transonic compressor resulted in noise reductions which were in general agreement with previous investigations on subsonic compressors. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-18837*# Brookhaven National Lab., Upton, N.Y. Biology Dept.
RADIOBIOLOGICAL STUDIES OF PLANTS ORBITED IN BIOSATELLITE 2
L. A. Schairer, A. H. Sparrow, and K. M. Marimuthu [1969] 10 p refs Presented at the Space Biol. Session of Working Group 5 of the COSPAR Meeting in Prague, 11–24 May 1969; Sponsored in part by AEC
(NASA Order R-104-7)
(NASA-CR-107799; BNL-13623; CONF-690516-1) Avail: CFSTI CSCL 06R

The Biosatellite II Tradescantia experiment probed the effects of the space environment on spontaneous and radiation-induced mutation rates and on cytological changes in Tradescantia clone 02. Analysis of data on somatic mutation, cell size, and chromosome aberrations endpoints showed no significant differences between flight and nonflight samples. However, pollen abortion frequency of micronuclei in pollen, and loss of reproductive integrity (stamen hair stunting) showed increases associated with weightlessness in irradiated material. Root tip and microspore cells showed effects of disturbed mitotic spindle function in orbited plants both with and without irradiation. Clearly differences exist between flight and nonflight material and the significance and possible mechanisms for these effects are being studied in continuing nonflight tests. Author (NSA)

N70-18967# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
THE EFFECTS OF EAR DEFENDERS ON SPEECH PERCEPTION IN MILITARY TRANSPORT AIRCRAFT
G. Froehlich *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 6 p (See N70-18962 06-07)
Avail: CFSTI

During aeromedical evacuation in noisy military transport aircraft, the necessary speech communication has to be guaranteed. To provide the best noise protection and speech communication, the following study has been carried out. 25 normal hearing subjects were submitted under a 104 dB aircraft noise to German double-digits with average speech levels of 93, 88 and 83 dB. The highest articulation scores and smallest standard deviations were obtained with Willson earmuffs, followed by wearing no defenders and the full filter earplug Com-Fit. By far the lowest scores had the low pass filter earplug Selectone K. The more unfavorable the ratios noise-speech, the more marked were the differences of mean scores. These results were supported by the assessment of the test subjects in terms of noise attenuation, discomfort and speech perception. The same results were obtained under the cabin noise of the reciprocating engine cargo aircraft Noratlas. A group of senior pilots with a marked high-tone hearing loss above 2000 cps under the same test conditions had much lower articulation scores especially with the more unfavorable noise to speech ratios. The reasons are discussed. Author

N70-18978# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
THE USE OF PSYCHOLOGICAL LEARNING THEORY MODELS IN THE DESIGN OF ADAPTIVE SYSTEMS
K. S. Narendra and I. J. Shapiro Aug. 1969 17 p refs Presented at the 1969 Systems Sci. and Cybernetics Conf., Philadelphia, 22–24 Oct. 1969
(Grant NSF GK-11097)
(CT-30) Avail: CFSTI

Optimal parameter value determination for control systems with multimodal performance criteria was suggested. This method which is based on the theory of finite-state automata is discussed in terms of method implications in the dual context of learning models in mathematical psychology. Author

N70-17004# Purdue Research Foundation, Lafayette, Ind.
SPEECH ANALYSIS Final Report, 1 Jan. 1965–31 Jul. 1969
Arthur S. House and George W. Hughes 31 Aug. 1969 68 p refs
(Contract AF 19(628)-5061)
(AD-696599; AFCRL-69-0371) Avail: CFSTI CSCL 17/2

As a general aim the research sought to advance the understanding of the processes of speech perception and speech production. In particular, the report outlines work on speech alternated and switched between the ears; the development and evaluation of a masking noise with speech-envelope characteristics; the estimation of fundamental frequency by harmonic identification; the identification of utterance-final stop consonants from spectrographic displays; and vowel-formant shifts associated with the tense-nontense distinction. The script materials developed for the perceptual studies are appended. Author (TAB)

N70-17033*# National Aeronautics and Space Administration, Washington, D.C.
LIFE SCIENCES, APPENDIX G

George Zuidema, A. M. Kontaratos, and D. B. Hoffman *In its* Proc. of the Winter Study on Uses of Manned Space Flight, 1975–1985 1969 p 111–162 refs (See N70-17026 06-34)
Avail: CFSTI

The roles of man in the life-sciences aspect of space flight are categorized as active and passive. The passive role includes medical measurements during prolonged space flight, and task performance measurements. A chart summarizing the effects of environmental factors on performance parameters is included. The active role is considered to consist of areas of discipline oriented activity, which are: (1) aerospace medicine, (2) biotechnology, (3) space biology, (4) exobiology, and (5) back-contamination containment and quarantine. It is concluded that physiological or performance degradation can be avoided through the use of preventive medical measures. F.O.S.

N70-17074# Illinois Univ., Urbana. Biological Computer Lab.
TOWARDS A SYSTEMATIC METHOD OF BEHAVIOR
Russell D. Stinaff Jun. 1969 133 p refs
(Contract AF 33(615)-3890; Grant AF-AFOSR-7-67)
(AD-696153; TR-15; AFOSR-69-2859TR) Avail: CFSTI CSCL 6/4

As an aid to the study of existing complex systems and the synthesis of new systems with specific properties, the establishment of a systematic method of behavioral modelling could prove to be of considerable value. Towards this end, certain mathematical processes consisting of determinate and partly determinate transition matrices applied sequentially to an n-state system have been examined for their ability to exhibit complex behavior. Four fully determinate matrix types and four partly determinate types comprise the set from which these processes are formed. Equilibrium conditions and relative process times are examined for a variety of processes involving one and two matrix types. Processes capable of demonstrating behavior similar to that involved in the phenomena of habituation and the conditioned reflex are discussed, including extended processes related to concurrent establishment of two or more conditioned reflexes. Author (TAB)

N70-17082# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
DEVELOPMENT OF MATHEMATICAL MODELS FOR HYBRID COMPUTATION. VOLUME 2: APPENDICES Final Report, 1 Oct. 1967–31 Oct. 1968
Robert J. Mc Laughlin and Alfred A. Pandiscio Apr. 1969 277 p refs
(Contract F19628-68-C-0042)
(AD-695815; AFCRL-69-0212-Vol-2) Avail: CFSTI CSCL 6/16

The work described in the report had three objectives. First, to select a number of realistic physical problems and develop mathematical models suitable for solution on both analog and digital computers. Second, to develop successively more complete versions of one of the models to determine its suitability for solution on a hybrid computer. Third, to examine the utility of the parallel logic capabilities of an otherwise conventional modern analog computer. Some five models of problems arising from the dynamic behavior circulatory and respiratory control systems were programmed and solved on a digital computer. Three were also solved on an analog computer. A digital detection system was simulated with emphasis given to utilizing parallel logic. The most elaborate of the respiratory models considered is recommended for further investigation on a hybrid computer. Author (TAB)

N70-17136# Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
TOXIC EFFECTS IN MONKEYS EXPOSED TO 100% OXYGEN AT AMBIENT PRESSURE Final Report, Jan.–Apr. 1968
Clarke C. Johnston, Marilyn E. George, James P. F. Murphy, and Kenneth C. Back Jul. 1969 33 p refs Prepared in cooperation with ITT
(Contract F33615-68-C-1270)
(AD-697071; AMRL-TR-68-178) Avail: CFSTI CSCL 6/19

Thirty-two monkeys were exposed to 100% oxygen at 750 mm Hg pressure for 4, 7, or 12 days, and the effects of this atmosphere on liver, kidney and lung morphology, kidney function, liver and kidney cellular respiration and energy production, and blood gas levels were studied. The mortality rate was approximately 40%. There was a mild uncoupling of oxidative phosphorylation and a decrease in ATP levels in liver and kidney tissue at all exposure times and a decrease in kidney function at 4 days with a return to normal levels by 12 days. However, the major effect was seen in the lung where the degree and time sequence of lung damage correlated fairly well with the blood Po2 levels. There were mild morphological changes at 4 days, with more severe effects at 7 days. At 12 days, four out of five monkeys had major lung damage whereas the remaining animal seemed to have only minor changes. The cause of death appeared to be hypoxia from severe diffuse lung damage. Author (TAB)

N70-17138# Michigan Univ., Ann Arbor. Human Performance Center.
REHEARSAL, INTERFERENCE, AND SPACING OF PRACTICE IN SHORT-TERM MEMORY Interim Report
Alexander Warren Pollatsek Jul. 1969 124 p refs
(Contracts AF 49(638)-1235; AF 49(438)-1736; Grant NIH GM-01231-05; ARPA Order 461)
(AD-696668; AFOSR-69-2798TR; Rept-08773-41-T; TR-16) Avail: CFSTI CSCL 5/10

Short-term memory as exhibited in a variety of experimental paradigms is heavily influenced by variations in the time allotted for rehearsal, in the time allotted for rehearsal-preventing interfering activity, and in the interval separating successive presentations of an item. The dissertation was designed to investigate systematically any interactions among rehearsal, interference, and spacing of practice in an effort to derive constraints on an adequate theory of short-term memory beyond those imposed by prior research. Author (TAB)

N70-17144# RAND Corp., Santa Monica, Calif.
STATISTICAL DETECTION THEORY OF THRESHOLD VISUAL PERFORMANCE
H. A. Ory Sep. 1969 45 p refs
(Contract F44620-67-C-0045)
(AD-696114; RM-5992-PR) Avail: CFSTI CSCL 6/16

The document presents the development of a statistical detection model to provide an accurate, quantitative description of threshold visual performance over a wide range of background luminance and target parameters. The work investigates relationships that exist between visual performance and reconnaissance. A statistical theory is developed in which neural excitation noise results from random fluctuations in both target and background luminance, and decision criterion is assumed to be programmed. Author (TAB)

N70-17152# Consultants in Engineering Science (Conesco) Watertown, Mass. Nuclear Div.
DECONTAMINATION OF FINITE RECTANGULAR AREAS Final Report
A. W. Starbird Aug. 1969 99 p refs
(Contract DAHC20-70-C-0216)
(AD-695668; CONESCO-4897) Avail: CFSTI CSCL 15/2

The CONSTRIP III computer code was used to calculate the reduction factors within single story rectangular buildings due to finite rectangular areas of contamination surrounding the buildings. The CONSTRIP code permitted breaking the reduction factors into wall scattered and non-wall scattered components from finite source strips up to 200 ft wide. Decontamination importance factors were determined for finite areas subjected to both 1.25 Mev and 0.66 Mev contamination. The directional responses for wall scattered radiation coming from above and below the detector plane were determined separately for finite source fields. Author (TAB)

N70-17171# Army Foreign Science and Technology Center, Washington, D.C.
ELECTRICAL SENSITIVITY OF THE EYE UNDER THE EFFECT OF THE INTENSE PHOTIC STIMULUS
V. I. Shostak 18 Sep. 1969 13 p refs Transl. into ENGLISH from Zh. Vysshe Nervnoi Deyatelnosti (USSR), v. 18, no. 2, 1968 p 339–343
(AD-696189; FSTC-HT-23-442-69) Avail: CFSTI CSCL 6/16

A study was made of the electrical sensitivity of the eye and the critical frequency of disappearance of a flickering electrical phosphene upon a 15 min. disadaptation with an intensity up to 70 nt and after a short and very bright flash. It has been found that in the former case electrical sensitivity diminishes, while the critical frequency (a measure of functional mobility) increases in the process of subsequent dark adaptation. After short superbright flashes, the changes also go into opposite directions, but they are of a phasic nature. The phenomena are probably a reflection of trace processes in the visual analyzer induced by intensive photic stimuli. Author (TAB)

N70-17199# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.
EFFECT OF INJECTED PARGYLINE UPON OPERANT AVOIDANCE IN THE MONKEY
Glayde D. Whitney, Daniel J. Craig, and W. Hanly Oct. 1969 20 p refs
(AD-696103; ARL-TR-69-12) Avail: CFSTI CSCL 06/15

Pargyline-HCl is of interest as a possible therapeutic agent in the treatment of decaborane intoxication. Decaborane in low doses is known to have severe disruptive effects upon instrumental behavior. Pargyline, in order to qualify as a therapeutic agent, must not itself lead to severe behavioral disruption. In this study each of five monkeys was given a single intraperitoneal injection of buffered suspension of pargyline, the dosage being equivalent to 45 mg pargyline-HCl/kg of body weight. Their behavior was evaluated for four days following injection on a concurrent free-operant avoidance schedule with two superimposed discriminated avoidance tasks. In no cases were pargyline-induced changes in behavior of sufficient magnitude to affect the efficiency of shock avoidance. It is concluded that the effect of pargyline on these behaviors is quantitatively slight in comparison to the effects of decaborane recorded in the literature, and that behavioral disruption from pargyline itself need not be the major consideration in decisions relevant to the therapeutic use of pargyline-HCl for decaborane induced behavioral intoxication. Author (TAB)

N70-17201# RAND Corp., Santa Monica, Calif.
THE IMPLICATIONS OF GEOGRAPHIC-SPECIFICITY FOR AIR POLLUTION ABATEMENT STRATEGY
Alan Carlin Oct. 1969 7 p refs Presented at the Symp. on the Develop. of Air Quality Standards, Los Angeles, 23-25 Oct. 1969
(AD-696806; P-4237) Avail: CFSTI CSCL 13/12

The paper presents some interesting and instructive models for determining optimal emission abatement for different categories of emitters under somewhat restrictive assumptions and a useful summary of some of the more recent literature on air pollution abatement strategy. Author (TAB)

N70-17259# Yale Univ., New Haven, Conn. School of Medicine.
UHF STIMULATION SYSTEM Interim Report, 1 Jul.–31 Dec. 1968
Jose M. R. Delgado and Gerhard Weiss Oct. 1969 23 p
(Contract F29600-67-C-0058)
(AD-696102; ARL-TR-69-11) Avail: CFSTI CSCL 6/2

A UHF remote stimulation system working in the 915 MHz band is described, which generates current pulses in three stimulation channels. The amplitude, duration, repetition rate and channel can be controlled from a remotely located control panel. This system has been installed at Holloman Air Force Base, New Mexico, to stimulate the brain of free ranging chimpanzees and study the induced modifications on individual and social behavior. Author (TAB)

N70-17275# Naval Medical Research Inst., Bethesda, Md.
MINIMUM THRESHOLDS FOR PHYSIOLOGICAL RESPONSES TO FLOW OF ALTERNATING ELECTRIC CURRENT THROUGH THE HUMAN BODY AT POWER-TRANSMISSION FREQUENCIES Interim Report
John C. Keesey and Frank S. Letcher 3 Sep. 1969 28 p refs
(AD-695782; MR-005.08-0030B; Rept-1) Avail: CFSTI CSCL 6/19

A survey was made of all available information about electric shock to humans, including children, at power-transmission frequencies of 50 and 60 Hz. Reliable quantitative data at these frequencies are available for three measurable physiological responses to electrical stimulation: (1) the perception of electric current flow, (2) uncontrollable muscular contraction, and (3) death. Relevant threshold conditions for response to minimum currents include the size and resistance of the body and the duration and pathway of current flow. One percent of the general populace can perceive from 0.1 to 0.5 mA of 50-60 Hz current, depending upon the type of hand contact made with an electrically-energized circuit. A safety threshold of 5 mA, recommended for the general population including children, is based upon the conclusion that any 50-60 Hz current in excess of the release threshold of an individual should be regarded as hazardous and potentially lethal. Ninety-nine percent of adult male workers should be able to release 9 mA of 50-60 Hz current. Voltages calculated from reliable experimental data on effective currents and expected resistances are lower than voltages generally recommended to be safe. Author (TAB)

N70-17308*# Sandia Corp., Alqubuerque, N.Mex.
PLANETARY QUARANTINE PROGRAM Quarterly Progess Report, Period Ending 30 Jun. 1969
Jun. 1969 42 p refs
(NASA-Order R-09-019-040)
(NASA-CR-107800; TID-25154) Avail: CFSTI CSCL 06M

Studies concerning sterilization models, qualitative sampling models, bioburden experimentation and models, and evaluation of release from surfaces of the spacecraft–lunar module adaptor (SLA) during launch are described. Along with these other phases of planetary quarantine problems, a study of the feasibility of combined irradiation and heat sterilization of spacecraft hardware is reported. Heat alone has presented difficulties since some instruments are vulnerable at high temperatures. Dry spores of Bacillus subtilis var. niger, temperature ranges of 100 to 125 C, and low doses of gamma radiation (under 150 krads) were used. Results indicated that a reduction of the initial population by 90% could be accomplished in roughly 30 to 50% of the time when heat and radiation were combined. Experiments with other organisms have also begun. Author (NSA)

N70-17353*# Exotech, Inc., Washington, D.C. Systems Research Div.
AN ANALYTICAL BASIS FOR ASSAYING BURIED BIOLOGICAL CONTAMINATION Interim Report
Robert C. Kline and Phillip L. Randolph Jan. 1969 36 p refs
(Contract NASw-1734)
(NASA-CR-107854; TRSR-036) Avail: CFSTI CSCL 06R

An analysis of a procedure for assaying biological contamination buried or embedded in spacecraft materials, is presented. The procedure required the controlled fracture of representative samples of a material whose buried loading is of interest. Each sample is tested for biological contamination on the totality of surfaces exposed as a result of the fracturing process. The basic datum or observation consists of the proportion of samples which yield contamination upon culturing. Conventional statistical techniques, combined with an assumed relation between

the mean concentration of organisms buried within the material and the observed datum, produce an upper bound estimate for the unknown mean concentration, expressed to any prescribed level of confidence. In principle, the "conservativeness" of the resulting estimate is directly related to the sample size and the amount of surface area exposed by fracture; as the sample size and/or exposed area increase(s) the difference between the estimate and the unknown mean load tends to decrease. Author

N70-17521*# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
A STUDY OF THE CHEMOSYNTHETIC GAS EXCHANGER, 22 JANUARY - 14 JUNE 1969
Leonard Bongers 14 Jun. 1969 17 p refs
(Contract NASw-1596)
(NASA-CR-107874) Avail: CFSTI CSCL 06M

The extent of byproduct formation for growth of H. eutropha under autotrophic conditions is assessed. In addition, results are presented on the assimilation characteristics of a number of organic acids in a heterotrophic environment by H. eutropha. Author

N70-17572*# Wisconsin Univ., Madison. Dept. of Radiology.
APPLICATIONS OF THE DIRECT PHOTON ABSORPTION TECHNIQUE FOR MEASURING BONE MINERAL CONTENT IN VIVO. DETERMINATION OF BODY COMPOSITION IN VIVO Progress Report
John R. Cameron 1 Aug. 1969 500 p refs
(Grant NGR-50-002-051; Contract AZ(11-1)-1422)
(NASA-CR-107888) Avail: CFSTI CSCL 06P

The following graphs and tables present summaries of data on normal individuals measured in the University of Wisconsin Bone Mineral Laboratory from the period 1965 to March 1969. Although a variety of bones were measured, these data are all for the radius near midshaft and essentially all of them were for the left arm. These data may be of interest to other groups using the same technique. It should be noted that all of the data are for whites with relatively little information on other races. Author

N70-17655*# California Univ., Los Angeles.
INTERRELATIONS OF PERCEIVED SIZE AND DISTANCE Final Report
22 Dec. 1969 8 p refs
(Grant NGR-05-010-010)
(NASA-CR-107855) Avail: CFSTI CSCL 05J

Significant aspects are presented of an investigation on the basic processes in size cue to distance tasks and the effect of perceived distance on perceived size. Principles of visual organization that are applicable to a variety of visual judgments were identified. D.L.G.

N70-17687# Edinburgh Univ. (Scotland). Visual Lab.
PSYCHOLOGICAL VARIABLES IN COLOUR VISION TESTING
R. Lakowski May 1969 17 p refs Presented at the First Intern. Congr. on Colour, Stockholm, 9-13 Jun. 1969
(AD-695343) Avail: CFSTI CSCL 5/10

The effect of psychological factors in the colour testing situation was assessed for a population of normal trichromats. The colour vision tests used were the F- M 100- Hue, the ISCC- CAT, BCMT, and P- N anomaloscope. Two hypotheses relating (a) personality factors to the difficulty of the discrimination task and (b) cognitive factors to the complexity of the test situation were put forward. Both hypotheses receive some confirmation from the experimental data although the effect of these psychological factors is small. From the results of factor analysis it appears that each colour test in this population is measuring an attribute specific to itself, from which it can be inferred that no one test can be regarded as a substitute for another. Author (TAB)

N70-17892 Texas Univ., Austin.
EFFECTS OF ADAPTATION ON VISUAL DETECTION
Hienz Albert Gaylord (Ph.D. Thesis) 1968 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No 69-6145

Some of the relevant factors which influence visual detection during partial dark adaptation were investigated using a ten-category rating procedure. Following partial dark adaptation each of the three human observers were light adapted with a 200 ms exposure to a 5.4 X 10 to the 6th power Td. circular 25 deg flash subsequent to which a 20 ms circular 5 deg test flash was randomly presented at successive six second intervals over a four minute period of dark adaptation. Analysis of the data showed that a rating procedure within a signal detection context provided a sensitive measure of the changes in visual sensitivity that occurred during dark adaptation and permitted the construction of dark adaptation curves for multiple detection criteria. The first minute of dark adaptation was found to be mediated primarily by cone mechanisms on the basis of the steep slopes and breaks noted in the 50% and 60% curves as well as the fact that the positive afterimage had a chromatic appearance during this time period. Dissert. Abstr.

N70-17964# Honeywell, Inc., St. Paul, Minn. Research Dept.
LASER RADIATION EFFECTS ON THE MORPHOLOGY AND FUNCTION OF OCULAR TISSUE Final Report, 1 Aug. 1968 - 31 Jul. 1969
Arthur E. Jones, Perry Spyropoulos, and Robert W. Massof Aug. 1969 39 p refs
(Contract DADA17-67-C-0019)
(AD-696447; Rept-12047-FRI) Avail: CFSTI CSCL 6/18

The effects of different energy levels of ruby laser radiation on electrophysiological, psychophysical and anatomical measures were examined. Spectral sensitivity tests, using an ERG analysis, demonstrated prolonged laser effects on rhesus and mangabey monkeys. At 15-months post-exposure for the rhesus monkey (0.8J/sq cm), the amplitude of the b wave was depressed at all wavelengths except 420 nm. At one-year post-laser exposure for the mangabey monkey (0.2J/sq cm), the amplitude of the b wave was depressed at all wavelengths and the amplitude of the b wave as a function of intensity at 570 nm was depressed by about 20 percent at high intensity and not affected at low intensity. Also, the third oscillatory potential remained absent. An ERG analysis of the Rayleigh match demonstrated that rhesus monkeys have normal color vision (A.Q. = 1.0), that squirrel monkeys are protanomalous (A.Q. = 0.305), and that owl monkeys are monochromatic (A.Q. = infinity). Following laser exposure of two rhesus monkeys the match was unbalanced in favor of the green component, indicating a protanomalous response. Behavioral studies of two rhesus monkeys, one laser exposed at 1.8J/sq cm and one exposed at 0.18J/sq cm, demonstrated a reduction in sensitivity at all but two spectral points for the monkey exposed at 1.8J/sq cm and no significant change in the sensitivity of the monkey exposed at 0.18J/sq cm. The latter monkey did, however, show a marked change in the shape of the function indicating an anomalous finding. Author (TAB)

N70-18001 National Lending Library for Science and Technology, Boston Spa (England).
SCIENTIFIC BASES FOR SENSORY ODOUR AND FLAVOUR ANALYSIS [WISSENSCHAFTLICHE GRUNDLAGEN DER SENSORISCHEN GERUCHS UND GESCHMACKSANALYSE]
Gisela Jellinek 1968 58 p Transl. into ENGLISH from Intern. Z. Lebensmittel und Lebensmitteltechnologie (German), v. 68, 1968 p 9-14, 84-90, 132-135, 185-188, 228-230, 269-271 Presented at the Assoc. of Ger. Chemists, Berlin, Jan. 1966; also presented at Inst. for Nutr. of the Ger. Acad. of Sci., Pottsdam-Rehbruecke, East Germany, Apr. 1967
(NLL-M-7700-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl. 6 NLL photocopy coupons

Described is a combined method of analytical instrumental and scientific executed sensory analysis for quality control in the food industry. Definite distinctions are made between: (1) analytical test procedures such as difference-, threshold-, ranking-, and quality tests; and (2) popularity tests such as preference evaluation, consumer surveys, and market research. Both methods are combined in odor and flavor testing procedures; their results depend mainly on establishing differences between two or more samples where the change of guessing is kept at a minimum. The recognized four basic tastes: salty, sour, bitter, and sweet are analyzed by parameterization and used in arriving at a final flavor profile for the individual components and their intensities in a product. A brief outline of training in taste description by flavor recognition tests is included. G.G.

N70-18047# Joint Publications Research Service, Washington, D.C.
MAN AMONG THE AUTOMATA
S. Ivanov 28 Jan. 1970 63 p refs Transl. into ENGLISH from the book "Chelovek Sredi Automatov" Moscow, Znaniye Publishing House, 1969 p 245 – 319
(JPRS-49703) Avail: CFSTI

A discussion of the psychology of the human thinking process in solving problems is presented, with the end object of developing a computer with problem solving capability. Investigations of animal and human thought processes are reviewed, along with descriptions of the way solutions came to men such as Poincare and Kekule. Illustrations of novel ways of problem solving are given; for example, adding another variant rather than selecting from variants present. The problem of optimal verbal communication is also considered for situations in which maximum information must be communicated in minimum space, as happens in air traffic controller operations. Studies of optimality, man-machine interfaces, and computer chess playing are outlined. Cybernetics, heuristics, and their interrelation are discussed. N.E.N.

N70-18048 Howard Univ., Washington, D.C.
MICROBIOLOGICAL AND TOXICOLOGICAL STUDIES WITH PASTEURELLA PSEUDOTUBERCULOSIS TOXIN: PATHOPHYSIOLOGICAL EFFECTS AND POSSIBLE MECHANISMS OF ACTION
James Allen Brown, Jr. (Ph.D. Thesis) 1968 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-5734

The crude toxin was isolated from Pasteurella pseudotuberculosis cells. Each lot was standardized by quantitative protein assay. The LD sub 50 was 2.4 microg/gm/24 hours and 0.6 microg/gm/72 hours; after lyophilization it was 5.2 microg/gm/24 hours and 3.13 microg/gm/72 hours. P. pseudotuberculosis toxin produced a shock-like syndrome in many animal species similar to that known to be produced by gram-negative bacterial endotoxins. Physicochemical properties were similar to those known to be characteristic of exotoxins. For example, it appears to be a heat labile protein. Pathophysiological findings were a marked leukopenia accompanied by an elevation in body temperature, an increase in respiration which reached a maximum in one hour, no significant change in the hematocrit, and no significant change in the EKG until the terminal phase. A progressive sequence of events culminated in the irreversible fall in blood pressure to shock levels. Dissert. Abstr.

N70-18062*# National Aeronautics and Space Administration, Washington, D.C.
STORAGE AND RETRIEVAL OF INFORMATION IN AEROSPACE MEDICINE. THE MATRIX APPROACH
G. Hoover, E. M. Roth, F. B. Benjamin, S. P. Vinograd, and J. W. Humphreys Jul. 1969 8 p
(NASA-TM-X-62632) CSCL 06E

A matrix covering 58 environmental factors and 142 physiological-psychological functions was prepared to make the information of the Compendium of Human Response to the Aerospace Environment readily available. The criteria in coding the intersections of the parameters are given. It is concluded that none of the current approaches to information storage and retrieval are suitable for the Compedium, and that the future approach appears to be a combination of matrix and computer. F.O.S.

N70-18088*# National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF SOLAR ACTIVITY ON THE FREQUENCY OF FUNCTIONAL LEUKOPENIAS AND RELATIVE LYMPHOCYTOSES [O VLIYANII SOLNECHNOY AKTIVNOSTI NA CHASTOTU FUNKTSIONALNYKH LEYKOPENIY I OTNOSITELNYKH LIMFOTSITOZOV]
N. A. Shults Feb. 1970 20 p refs Transl. into ENGLISH of Acad. of Med. Sci. USSR summary report, 1967
(NASA-TT-F-592) Avail: CFSTI CSCL 06P

The effect of solar activity on the cell composition of blood is investigated using statistical methods. Data on inhabitants of the Arctic region is compared with data on inhabitants of the subtropics. It was found that the percentage of leukopenia in the north was higher than in the south. Analysis of the incidence of functional leukopenias has revealed a strict pattern of fluctuations in the leukocyte count under nonpathological conditions. F.O.S.

N70-18135# Directorate of Scientific Information Services, Ottawa (Ontario).
THE INTENSITY OF THE NARCOTIC ACTION OF HYDROGEN AT HIGH PRESSURE
N. V. Lazarev Oct. 1969 5 p refs Transl. into ENGLISH from Farmakol. i Toksikol., (USSR), v. 6, 1943 p 29 – 32
(T-532-R) Avail: CFSTI

The biological narcotic action of hydrogen under pressure was tested in a preliminary experiment on a white mouse in a pressure chamber containing a mixture of 95 percent nitrogen and 5 per cent oxygen; a hydrogen feed up to 55 atmospheric pressure of the nitrogen hydrogen mixture did not produce narcosis. The animal stayed alive even at total pressure of 90 atm with the hydrogen partial pressure at 55 atm. It was concluded that the presence of hydrogen hardly effected the toxicity of the gaseous mixture which already contained a narcotic concentration of carbon monoxide. G.G.

N70-18150# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PECULIARITIES OF HUMAN SLEEP UNDER CONDITIONS OF CONTINUOUS PROLONGED INFLUENCE OF BROAD-BAND NOISE OF AVERAGE INTENSITY
V. I. Myasnikov et al 1 Apr. 1969 22 p Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Ser. Biol. (USSR), v. 33, no. 1, 1968 p 89 – 98
(AD-696500; FTD-MT-24-499-68) Avail: CFSTI CSCL 6/19

Studies were conducted at the Prof. F. D. Garbov laboratory on the effects of continuous protracted broad band noise on sleep and on the transitional state between sleep and wakefulness to determine the physiological basis for the disturbing effects of noise on man during rest. Quality of sleep was evaluated subjectively, and by the dynamics of the bioelectric activity of the brain, reactions of waking to acoustic stimulation, changes in performance indices (sensory motor reactions to light stimulus) and deviation of certain acoustic sensitivity indexes (screening threshold and acoustic adaptation). A relationship between length of presleep and subsequent sleep stages was established: those who fell asleep rapidly slept soundly and awoke feeling well, while those having difficulty falling asleep slept lightly, awakened frequently, and did not feel well. EEG observations were made. The motor reflex latent period was reduced in the first group and increased in the second group compared to background data. In the first group function of the auditory analyzer was restored and in the second group it was not, as shown by respectively lowered and raised screen thresholds.

In the first group the disturbance of acoustic adaption (after 8 hr exposure to noise) was reduced or completely eliminated, while in the second group it did not level out. Author (TAB)

N70-18184# National Institutes of Health, Bethesda, Md. Library Div. Research Sciences.
RESEARCH OF STRUCTURAL CHANGES IN A NERVE DURING EXCITATION AND IN ARTIFICIAL MEMBRANES UNDER THE ACTION OF AN ELECTRICAL FIELD BY OPTICAL METHODS
G. N. Berestovskii et al 1969 62 p refs Transl. into ENGLISH from Pushchino, VINITI (RUSSIAN), 1969 64 p
(Rept-10-5-69) Avail: Issuing Activity

The structural and physicochemical changes in nerves, that occur when there is a change in ionic permeability, are investigated by optical methods, at the molecular and hypermolecular levels. These structural changes are divided into two groups. To one group belong those changes which are directly connected with the regenerative cycle of the generation of the action potential, and to the other group are assigned the slow changes which accumulate from impulse to impulse associated with metabolic changes. It is concluded that during the generation of the action potential, a reversible decrease occurs in the light flow which passed through the nerve fiber and the crossed polarizer and analyzer, and the decrease of the light flow occurs simultaneously with the action potential and repeats its shape. This phenomenon is related to the change of the parameters of the axon under the action of an electrical field. F.O.S.

N70-18211# Defence Research Board, Ottawa (Ontario).
DEPTH INTOXICATION IN DIVING WITH AIR
Pierre Cabarrou Nov. 1969 12 p refs Transl. into ENGLISH from Presse Med. (Paris), v. 72, no. 13, 1964 p 793-797
(DRB-T-6-F) Avail: Issuing Activity

Recent investigations into the physiological and behavioral effects of deep diving with respiratory equipment containing various air mixtures are reviewed. Two theories that explain the disorders produced under these circumstances are explained and their validity analyzed on the basis of test data. The first theory, that of nitrogen narcosis, states that nitrogen has a depressive action on the central nervous system sufficient to cause the symptoms. The second hypothesis is based on the fact that compression of the respiratory mixture increases its specific gravity to a hypoventilation. The hypercapnia resulting from this causes the effects that have been noted. From the test data, the conclusion is reached that depth intoxication is not caused by retention of carbon dioxide, although any hypercapnia occurring during the dive will aggravate the disorders. It is thought instead that the intoxication is caused as a result of some yet unknown mechanism triggered by breathing neutral gas under pressure. Strong conclusions were reached that no narcosis is involved. A.C.R.

N70-18226 Pittsburgh Univ., Pa.
EFFECTS OF CHANGES IN ENVIRONMENTAL LIGHTING ON PARADOXICAL SLEEP IN THE ALBINO RAT
Ross Fishman 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-6398

The possible effects of changes in environmental lighting conditions on sleep states were studied in adult male albino rats. EEG records were used to determine time spent in pardoxical sleep (PS) and slow-wave sleep (SWS). In a pilot study the effects of continuous darkness and continuous light were determined. Following exposure to a L-12, D-12 light cycle (baseline), rats were exposed to either three weeks of continuous darkness or continuous light. The results indicated that rats in continuous darkness showed increases in minutes of PS and SWS and of PS as a percentage of total sleep (%PS). Rats in continuous light showed decreases in PS and %PS with little overall change in SWS. These results lend support to the proposition that under appropriate conditions "lights-off" facilitates the appearance of PS while lights-on may inhibit paradoxical sleep appearance. Dissert. Abstr.

N70-18237# National Institutes of Health, Bethesda, Md. Library Div. of Research Sciences.
POLYGRAPHIC STUDY OF SLEEP IN THE PIG
Y. Ruckebusch et al 1968 10 p refs Transl. into ENGLISH from C R Soc. Biol. (Paris), v. 162, no. 7, 1968 p 1346-1354
(Rept-10-7-69) Avail: Issuing Activity

Sleep states which are well individualized on the behavioral level in the growing pig are analyzed by polygraphic means in order to establish both the duration of each sleep state and the concomitant cardiorespiratory signs. Young pigs aged 3 to 4 months were observed for more than 20 complete 24-hour cycles resulting in data on the electrical activity of the cortex and the states of sleep, a comparative study of hypnograms and actograms, and observations of somato-vegetative manifestations during sleep. Two states of sleep are demonstrated in the growing pig: (1) Rapid sleep phases are characterized by rapid ocular movements with facial clonus and rapid cortical activity (8 to 10%) and comprise about 20% of total sleep time, approximating the values in man. (2) Slow sleep phases are accompanied by slow cortical waves and spindles (45% of the 24 hours). The organization of the phases of rest and activity and of alternations of wakefulness and sleep occur in relation to meals. The polygraphic study reveals an extreme complexity in the evolution of spontaneous motility, cardiac frequency, and respiratory rhythm during a 24-hour period. M.H.E.

N70-18251# National Institutes of Health, Bethesda, Md. Translating Unit.
NIGHT SLEEP OF THE SCHIZOPHRENIC AT THE START OF EVOLUTION. POLYGRAPHIC STUDY BY TELEMETRY
J. D. Vincent et al 26 Apr. 1969 10 p Transl. into ENGLISH from Ann. Medicopsychol., (Paris), v. 2, 1968 p 227-235
Avail: CFSTI

The night sleep of a group of 11 normal control subjects, 15 schizophrenics, and 4 patients with chronic hallucinatory psychosis quantitatively and qualitatively by telemetry recording. Recordings involved three parameters: ocular movements, electroencephalography, and muscle state. Analysis of the tracings indicates: (1) At the onset of their illness, schizophrenics do not show any major quantitative abnormality of rapid eye movements. (2) The schizophrenics were insensitive to the first night effect which did play a role in the sleep of the control subjects. (3) Dormition was more variable in the schizophrenics than in the normal subjects and its mean value was higher in the shizophrenics. (4) The time of appearance of the first rapid eye movements was higher, and the mean duration longer, in the normal subjects. (5) In the chronic hallucinatory psychosis subjects (all insomniacs), there was less rapid eye movement suggesting a relationship between insomnia, the poverty of rapid eye movements, and the symptomatic richness of the illness. D.L.G.

N70-18278# Congress. House. Committee on Science and Astronautics.
THE FUTURE OF THE BIOSCIENCE PROGRAM
Washington GPO 1970 242 p Hearings before Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., No. 11, 12-13, 17-18 Nov. 1969
Avail: Subcomm. on Space Sci. and Appl.

Testimony and discussions on the future of bioscience research are documented, with emphasis on the Biosatellite 3 mission and biomedical aspects and foundations of manned space flight. The future directions of NASA programs in the life sciences are briefly discussed, along with life support systems and biological effects of aerospace environments. J.A.M.

N70-18278# Congress. House. Committee on Science and Astronautics.
FUTURE OF THE BIOSCIENCE PROGRAM OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Philip P. Dickinson and Frank R. Hammill, Jr. Washington GPO 1969 41 p Presented to the Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., By the Subcomm. on Space Sci. and Appl., 24 Dec. 1969 *Its* Serial I
Avail: Subcomm. on Space Sci. and Appl.

An analytical report is presented on the exploratory hearings held to assess the biomedical planning which may be required to establish the extent and limits of human endurance to the space environment. Two alternative approaches to the future of NASA'S bioscience program are cited: a new biosatellite approach, involving more refined and extensive subhuman and instrumental experimentation, in additional space flights of 30 days or longer; and the incremental manned flight approach under the AAP program, with or without primates aboard as in-flight laboratory test subjects. It was recommended: (1) The abandoned biosatellite program of animal experimentation in earth orbit should be reinstituted. (2) Bioscience research should be extended to the planets when technologically feasible. (3) To justify space exploration costs, the role of science should be uprated as a mission objective, and bioscience programs in the fields of medicine and physiology should be given highest relative priority by NASA and Congress. M.G.J.

N70-18284# Joint Publications Research Service, Washington, D.C.
PROTON IRRADIATION OF MICROCOCCUS RADIODURANS AND SARCINA FLAVA MICROORGANISMS PLACED IN A METEORITE
G. P. Vdovykin et al 22 Dec. 1969 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 189, no. 1, 1969 p 192–195
(JPRS-49492) Avail: CFSTI

The survival percentage of microorganisms undergoing irradiation was considered in the process of experimental work on the radiogenic synthesis of complex organic substances from gases during high energy proton irradiation. The resistance of microorganisms placed in a meteorite was investigated during proton irradiation of 600 MeV. The experiments show that even such radiation resistant microorganisms as Micrococcus radiodurans perish under the effect of the radiation dosage used. If it is assumed that microorganisms may have been found in portions near the surface of bodies ancestral to meteors, they could not have survived due to high energy cosmic and solar radiation. These conclusions are confirmed by the total absence of microorganisms in the lunar rocks and soil brought back to earth by the Apollo 11 missions. R.B.

N70-18286# Joint Publications Research Service, Washington, D.C.
EFFECT OF SUSPENDED PARTICLES ON BREATHING INVESTIGATED
V. I. Babin 2 Jan. 1970 7 p refs Transl. into ENGLISH from Gigiena i Sanit. (Moscow), no. 10, Oct. 1969 p 49–53
(JPRS-49537) Avail: CFSTI

The coefficient of retention, or effective retention, of dust in the respiratory organs is generally understood to mean the percentage of aerosol particles which have settled or accumulated over a certain time interval in some part of the respiratory system with respect to all inhaled dust particles. Coefficients of retention are classified according to the principle of evaluating the percentage of dust retained, as a function of the time of accumulation of the aerosol particles in the respiratory organs, according to the location where the dust deposit settles in the respiratory system, according to the size distribution of the particles inhaled and retained, as a function of breathing conditions, and according to the type of dust. A classification table and formulas are constructed for the different coefficients of retention. R.B.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-16908*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO 10 WATER SERVICING, 22 OCTOBER 1968–17 MAY 1969
A. P. Buck, P. LaTorre, V. E. Christensen, and E. Wright 17 Nov. 1969 112 p Prepared by TWA
(NASA-TM-X-64055; GP-785) Avail: CFSTI CSCL 06K

Complete documentation is presented on the chemical, microbiological, and particulate analyses of the Apollo 10 water systems. These water servicing analyses included the verification of facility demineralized water, ground support equipment water units, lunar module, command module spacecrafts, portable life support system, liquid cooling garment, suit wick wetting units, and sterilization of water dispensers. Author

N70-16963# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
BINAURAL HEARING IN AERONAUTICAL APPLICATION
Hans J. Zetzmann *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 10 p refs (See N70-16962 06-07)
Avail: CFSTI

Partial results of a running experiment are described which determine values of binaural delay, amplitude disparity and of reverberation required to produce an optimum perception of sound direction in the practical situation of headset reception by the pilot in the cockpit or at the air traffic controller's desk. The different influences are studied with a special test setup of microphones and loudspeakers in an anechoic chamber in order to find out the principles for optimum efficiency in directional hearing and to give reference data for electrical circuitry which allows to separate three different information channels reaching the listener simultaneously, that is to give the best gain in intelligibility. When correctly engineered, this circuitry provides a significant progress towards a better adaptation of equipment to man and is to facilitate many informational tasks in the aeronautical field and elsewhere. Author

N70-16970# Naval Aerospace Medical Inst., Pensacola, Fla.
IN-FLIGHT MANIKIN RECORDINGS FOR EVALUATING THE EFFICIENCY OF FLIGHT HELMETS AND RADIO COMMUNICATION SYSTEMS
Carl E. Williams, John R. Forstall, and James W. Greene *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 11 p refs (See N70-16962 06-07)
Avail: CFSTI

An exploratory study has been conducted to determine the feasibility of obtaining and using in-flight manikin recordings to evaluate flight helmets with respect to both noise attenuation and speech intelligibility. Intelligibility test materials were transmitted to six air-borne subjects and a manikin as each was fitted with different flight helmets. Similar test materials were presented to the same six subjects in a simulated flight situation. Recordings obtained via the air-borne manikin were subsequently played back in the laboratory. Comparison of listener scores obtained in the three test situations revealed that scores obtained for the manikin recordings approximated those obtained during the in-flight tests; relative differences between three helmets for the two test situations were very similar. Standard deviations calculated from listener scores obtained for the three test situations revealed less variance for the manikin recordings. In-flight manikin recordings may provide valuable information for evaluating flight helmets and radio communication systems. Author

N70-16982# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
LEARNING CONTROL SYSTEMS: REVIEW AND OUTLOOK
King-Sun Fu Oct. 1969 59 p refs
(Grants AF-AFOSR-1776-69; NSF GK-1970)
(AD-696601; TR-EE-69-41; AFOSR-69-2851TR) Avail: CFSTI CSCL 9/2

The basic concept of learning control is introduced, and the following five learning schemes are briefly reviewed: (1) trainable controllers using pattern classifiers, (2) reinforcement learning control systems, (3) Bayesian estimation, (4) stochastic approximation, and (5) stochastic automata models. Potential applications and problems for further research in learning control are outlined. Theoretically, the algorithms have similar learning properties but, from an engineering viewpoint, the a priori information required and the computation involved are different for the different techniques. Author (TAB)

N70-17072# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
CAPTURING CONCEPTS IN A SEMANTIC NET
Anthony Bell and M. Ross Quillian 6 Oct. 1969 55 p refs
(Contract F19628-68-C-0125; ARPA Order 627)
(AD-697035; BBN-1885; AFCRL-69-0438; SR-13) Avail: CFSTI CSCL 6/4

A working memory model based on a semantic network is described in detail. Some advantages and disadvantages of such a model are discussed. An attempt is made to enable a reader to learn to perform the formidable task of representing data in the memory format. Since the actual memory is not easily read (or written), a set of LISP programs are included which make these tasks manageable. Author (TAB)

N70-17114# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ANTHROPOMETRIC DIMENSIONS OF AIR FORCE PRESSURE-SUITED PERSONNEL FOR WORKSPACE AND DESIGN CRITERIA Final Report
Milton Alexander, John W. Garrett, and Michael P. Flannery Aug. 1969 265 p refs
(AD-697022; AMRL-TR-69-6) Avail: CFSTI CSCL 6/14

The results of an anthropometric survey of USAF personnel wearing the A/P22S-2 Full Pressure Suit fitted in accordance with the USAF Eight-Size, Height-Weight Sizing Program are presented. One hundred and thirty-eight measures were taken on each of thirty-four subjects standing, sitting and supine, with the suit in the uninflated, inflated, and inflated-restrained conditions. Forty circumferences were measured on a separate sample of thirty-two subjects standing and sitting, with the suit uninflated and inflated. Pictorial and verbal descriptions of the dimensions and detailed numerical results, including clearance ranges, are presented. Graphs comparing various dimensions across suit sizes are presented in the Appendix. Author (TAB)

N70-17156# George Washington Univ., Alexandria, Va.
HUMAN FACTORS IN AIRMOBILITY
Wallace W. Prophet Oct. 1969 18 p refs Presented at the Army Sci. Advisory Panel, Fort Rucker, Ala. May 1969 Its Professional Paper 31-69
(Contract DAHC 19-69-C-0018)
(AD-697081) Avail: CFSTI CSCL 5/5

The paper describes the general organization of the Army Human Factors and Social Science Research Program and its principal research agencies, and discusses current research activities of HumRRO Division No. 6 (Aviation). These activities include studies of prediction of aviator performance, systems engineering of aviation maintenance training, human information processing functions in aerial reconnaissance and surveillance systems, and aviation simulation and training device requirements. Selected human factors research areas of significance to Army airmobility during the 1970-1980 period are also discussed. These are grouped under problems related to airmobile operational considerations, hardware considerations, and human learning considerations. Author (TAB)

N70-17164# Royal Aircraft Establishment, Farnborough (England).
A STANDPIPE HEAT EXCHANGER FOR USE IN A STANDARD CARBON DIOXIDE GAS SUPPLY SYSTEM FOR POWERED ARTIFICIAL LIMBS
A. J. Barter and R. Hastings Dec. 1968 32 p
(RAE-TR-68298) Copyright. Avail: CFSTI

Irregular pressure regulation and abnormally high system pressures occurring under certain conditions in a standard carbon dioxide gas supply system used for artificial limbs were investigated. A major reason for the reported malfunctioning was found to be the presence of carbon dioxide liquid downstream of the pressure regulator. In an attempt to overcome this problem, alternative cylinder non-return valves were evaluated and two standpipe devices were designed and tested. Some recommendations are made which should improve the performance of both existing and future gas supply systems. In addition, the pressure drop created by the standard connecting tubing and the reduced pressure control characteristics of the standard pressure regulator were examined. Author (ESRO)

N70-17262# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AEROSOL BEHAVIOR IN HIGH PRESSURE ENVIRONMENTS
Robert A. Gussman and Anthony M. Sacco 31 Oct. 1969 61 p refs
(Contract N00014-69-C-0228)
(AD-696643; BBN-1884) Avail: CFSTI CSCL 6/11

The report finalizes two phases of a broad study whose general purpose is to elucidate hazards to personnel arising from aerosols in high pressure helium-oxygen atmospheres. Studies have been completed on the generation of aerosols within high pressure environments and experimental evidence has been gathered which generally indicates that particle diameter increases with increasing pressure to a slight degree but there is a remarkable reduction in numbers concentration of particles. Pulmonary deposition models have been finalized and indicate increases in deposition in the lower respiratory tract with increasing pressure. Author (TAB)

N70-17543*# Illinois Univ., Urbana.
ENGINEERING AIDS FOR THE HANDICAPPED
H. W. Knoebel, J. G. Burr, and G. Stupp *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 346-348 ref (See N70-17528 06-34)
Avail: CFSTI CSCL 06B

A preliminary design is described for a highway vehicle to be operated by a severely disabled person. A vehicle is being donated, and a proposal has been written or further study and the modification of the donated vehicle. A technique which may enable blind to read newsprint is described. Author

N70-17720*# Hamilton Standard, Windsor Locks, Conn.
ALTERNATE MISSION STUDIES (AILSS)
Jul. 1969 127 p
(Contract NAS1-7905)
(NASA-CR-66876) Avail: CFSTI CSCL 06K

The advent of longer duration space flights has necessitated the development of a new generation of environmental control and life support equipment and techniques. To satisfy future requirements, the evolution of such systems has been toward developing processes employing regenerative type life support equipment. The "Trade-off Study and Conceptual Design of Regenerative Advanced Integrated Life Support Systems (AILSS)" report describes various systems which meet this objective. The AILSS report is used to supplement the material presented here, particularly in regard to the candidate concept descriptions discussed within this report. An evaluation of two additional environmental control and life support systems for an early AILSS type mission

with resupply every 180 days is presented. Two different electrical power supply systems are considered, and the optimum subsystem concepts for each power supply are chosen. One of the systems (Mission A) uses solar cell power which is extremely limited. The other system (Mission B) uses a Brayton cycle power supply where power is not a limitation. Flight dates for both systems are in the 1975-1977 period. Author

N70-17907*# Hamilton Standard, Windsor Locks, Conn.
THE IMPACT OF VEHICLE LEAKAGE ON THE AILSS
Nov. 1969 51 p
(Contract NAS1-7905)
(NASA-CR-66875) Avail: CFSTI CSCL 06K

This supplementary study discusses the influence of cabin leakage on the AILSS. The influence of leakage on oxygen generation is most complex, because hydrogen obtained from decomposition of oxygen or nitrogen-containing chemicals may be used in a reactor for carbon dioxide reduction. This necessitates expanding the scope of the AILSS oxygen generation tradeoff to include generation of oxygen and nitrogen for leakage makeup. Because oxygen generation is the only AILSS area where leakage rate has a drastic impact on concept selection, it is considered at greater length than other topics in this discussion. This subject is also of particular interest, because some of the alternatives described may form the basis for earlier life support systems. Conclusions regarding subsystem selection are indicated in figures which show the influence of leakage rate on AILSS concept selections. Here and throughout this report, "leakage rate" denotes total vehicle leakage to space, including both oxygen and nitrogen. In general, the leakage range considered is sufficient to determine the equivalent weight impact for any reasonable leakage rate. Author

N70-17919# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF REALIZING ADAPTIVE RECOGNITION SYSTEMS
L. V. Klykov et al 26 Mar. 1969 12 p Transl. into ENGLISH from Proceedings of the 3d All-Union Conf. Process of Sci. and Tech. Inform., Moscow, 1967 p 241-244
(AD-696407; FTD-MT-24-77-69) Avail: CFSTI CSCL 06H

The use of electron optics and noncoherent optics makes it possible to develop multilayer perceptrons with crossover couplings and feedbacks. A parallel-action perceptron is described which is equipped with lens screens, photoscopic masks, and image converters which have two storage screens and reflector screens. The use of such screens makes possible the repeated reading of information from the potential contour obtained on the dielectric of the storage. Author (TAB)

N70-17953*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND PERFORMANCE OF A HEART ASSIST OR ARTIFICIAL HEART CONTROL SYSTEM USING INDUSTRIAL PNEUMATIC COMPONENTS
John A. Webb, Jr. and Vernon D. Gebben Washington Jan. 1970 25 p refs
(NASA-TM-X-1953; E-5173) Avail: CFSTI CSCL 06E

The design of a pneumatic driving system for heart assist or total heart replacement pumps is given. The system provides square pressure waveforms to drive the heart assist and uses feedback control to regulate a total heart replacement pump. A pneumatic square wave generator was developed to serve as a flexible tool for studying various cardiac assist techniques. This generator can be synchronized with the natural heart using the R-wave of the electrocardiogram as a trigger. The addition of feedback control to regulate a total heart replacement is discussed and data is given. Author

N70-18043# Joint Publications Research Service, Washington, D.C.
MODELING OF THE PSYCHE
A. N. Bratko 29 Jan. 1970 121 p refs Transl. into ENGLISH from the book "Modelirovaniye Psikhiki" Moscow, Nauka, 9 Jan. 1969 p 9-117, 165-173
(JPRS-49710) Avail: CFSTI

Theoretical problems and practical attempts at making models of the psyche are discussed. Models are divided into physical, material-mathematical, and logical-mathematical types, and the making of models of biological systems is traced from ancient times to the present. It is felt that there is no substantial difference between psychic and machine operations, and that the essence of psyche modeling is the transference of more perfect operations to the cruder machine operations. The psychology of memory, thinking, perception, and learning is reviewed, and practical aspects of making models are described. Examples of models and experiments performed with them are discussed. N.E.N.

N70-18044# Joint Publications Research Service, Washington, D.C.
BIOMECHANICAL SYSTEMS DISCUSSED, EXPLAINED Interview with Ivan Ivanovich Artobolevski
22 Jan. 1970 5 p Transl. into ENGLISH from Urania (East Ger.), Dec. 1969 p 30-33
(JPRS-49667) Avail: CFSTI

A brief discussion, given in an interview, is presented on mechanisms which can perform functions of purposeful human activity under conditions to which man is not accustomed or cannot expose himself. Examples of these conditions are space stations, another planet, the ocean floor, and danger zones in nuclear technology. The control systems can be electronic systems based on biological currents, or biomechanical systems such as manipulators and pedipulators. N.E.N.

N70-18084*# Stanford Research Inst., Menlo Park, Calif.
EFFECTS OF SONIC BOOMS AND SUBSONIC JET FLYOVER NOISE ON SKELETAL MUSCLE TENSION AND A PACED TRACING TASK
Jerome S. Lukas, Donald J. Peeler, and Karl D. Kryter Washington NASA Feb. 1970 44 p refs
(Contract NAS1-7592)
(NASA-CR-1522) Avail: CFSTI CSCL 06P

Electrical activity in the trapezius muscle of the shoulder in twelve subjects was monitored while they were: (1) performing a paced tracing task in the presence of occasional simulated indoor sonic booms of 2.5 pounds per square foot (as measured outdoors), (2) performing a paced tracing task in the presence of occasional subsonic jet flyover noise of 100 PNdB (perceived noisiness in dB), (3) performing the tracing task under quiet conditions, (4) seated at rest in the presence of occasional simulated indoor sonic booms. A measure of time-on-track during a paced tracing task was obtained. A group of three subjects (males, 31 to 44 years of age), was tested under each of the four conditions. Simulated sonic booms increased the electromyographic activity in the group who performed the tracing task as well as in the group who heard booms while seated at rest. In addition, the booms were found to degrade tracing performance during the five test sessions. Flyover noises did not affect tracing performance nor result in electromyographic responses of the magnitude found as a result of the sonic booms. Author

N70-18109# Joint Publications Research Service, Washington, D.C.
THE PROBLEM OF THE OBJECTIVE FOUNDATION OF BIONICS
S. N. Smirnov 20 Jan. 1970 15 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 11, 1969 p 117-128
(JPRS-49644) Avail: CFSTI

A discussion is presented on the origin, development, and nature of bionics. The essence of the bionic principle is given as the search for appropriate designs in living nature and the elaboration of the methods and means of reproducing the specific features of the biological solutions to functional problems analogous to

engineering problems. Bionics is considered to be the study of only those features which are common to and inherent in both living systems and engineering systems, and the specific nature of design-functional relations in the two systems is discussed. The foundation of bionics is identified as the objective laws at the basis of the bionic approach to solving engineering problems. This is seen to incorporate not only the idea of using biological principles in engineering, but also the idea of applying the laws of constructional homomorphism and isomorphism of functionally identical systems in engineering creativity. N.E.N.

N70-18300# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND THE SCIENTIFIC-TECHNICAL REVOLUTION
8 Jan. 1970 23 p refs Transl. into ENGLISH from Visny Akad. Nauk. Ukr. RSR (Kiev), v. 33, no. 5, 1969 p 3-7, 44-52 81-82
(JPRS-49568) Avail: CFSTI

The part played by cybernetics in economic forecasting, planning, and automatic production control and distribution is reviewed. The increased demand for well-trained scientists and technicians in response to computer-based technological advances is emphasized as well as the need to maximize the creative use of increased leisure time. Scientific control of the social factors of production is assessed. A brief account is given of a symposium on the accuracy and efficiency of computer algorithms. E.C.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-16912# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
NUCLEAR MAGNETIC RESONANCE IN SOLID HELIUM 3-HELIUM 4 MIXTURES BETWEEN 0.3 K AND 2.0 K
D. S. Miyoshi, R. M. Cotts, A. S. Greenberg, and R. C. Richardson
Aug. 1969 51 p refs
(Rept-1202) Avail: CFSTI

Techniques have been used to study vacancy diffusion and the exchange interaction of He-3 in solid He-3 - He-4 mixtures. There is good agreement between the diffusion activation energies determined from the T2 measurements and those obtained by measuring the diffusion constant directly using the field gradient technique. The T2 data in the Zeeman exchange plateau region supports the idea of a single spectral density for each solid phase. The exchange interaction is independent of concentration. The T2 data in the exchange narrowed region is not in agreement with theory obtained by allowing the moments of the lineshape to become concentration dependent. The experimental values of T2 are much lower than the predicted values. This deviation is qualitatively explained by postulating the existence of two spin species. A small fraction of the isolated spins can then dominate the T2 relaxation process. Author

N70-16928 National Lending Library for Science and Technology, Boston Spa (England).
THE THERMAL DECOMPOSITION OF PERCHLORIC ACID [TERMICHESKOE RAZLOZHENIE KHLORNOI KISLOTY]
V. Ya. Rosolovskii 17 Jul. 1969 36 p refs Transl. into ENGLISH from the book 'The Chem. of Anhydrous Perchloric Acid' Nauka, Moscow, 1966 Chapter 7
(NLL-RPE-Trans-23-(8036.47); UDC-546.137-33) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

Thermal decomposition of perchloric acid is described. Formation rates of gaseous and liquid products from acid decomposition are given for a range of acid concentrations and temperatures. Particular attention is given to the stabilizing effect of small additions of organic compounds containing the trichloromethyl group. A mechanism is proposed, and additive action for acid stabilization is discussed. Author

N70-16950# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AZEOTROPIC RECTIFICATION OF A MIXTURE OF SILICON TETRACHLORIDE WITH TRIMETHYLCHLOROSILANE IN THE PRESENCE OF ACETONITRILE
T. P. Korablina et al 27 Mar. 1969 15 p refs Transl. into ENGLISH from Plast. Massy, (USSR), no. 11, 1966 p 22-25
(AD-696607; FTD-HT-23-959-68) Avail: CFSTI CSCL 7/4

Batch and continuous units are described for separating binary azeotropes consisting of SiCl4 plus acetonitrile(CH3CN) (b.p. 49.1C) and (CH3)3SiCl and CH3CN (b.p. 56.5C). The 1st unit consists principally of 3 rectification columns. In the 1st, the low-boiling and higher boiling components are separated from the crude SiCl4 and (CH3)3SiCl mixture. In the second and third, SiCl4 and (CH3) 3SiCl are separated. The experimental results were in close agreement (9 to 12 percent deviation) with those calculated. Author (TAB)

N70-16990 National Lending Library for Science and Technology, Boston Spa (England).
ROLE OF PYRROHOTITE IN THE OXIDATIVE AUTOCLAVE LEACHING OF SULFIDES
Y. M. Shneerson et al 21 Jul. 1969 25 p refs Transl. into ENGLISH from Tr. Proektn. Nauch.-Issled Inst. Gipronikel USSR (Leningrad), no. 29, 1966 p 24-38 In RUSSIAN and ENGLISH
(NLL-Trans-746-158-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The ore and concentrate samples employed in this investigation contained at least 30 to 35 percent sulfides and were obtained from existing and newly developed deposits in the Soviet Union. Tables listing sample chemical and mineral compositions are included. The principal sulfide minerals in the ores were pentlandite, chalcopyrite, and pyrrhotite, with the amounts of the first two components fluctuating within relatively narrow limits and the pyrhotite content varying considerably. Experimental results show: (1) The ratio of leaching of metals from sulfide nickel ore materials containing no less than 30 percent sulfides depends on the pyrrhotite content; the higher the pyrrhotite content, the lower the leaching rate. (2) The inhibiting action of pyrrhotite manifests itself in the precipitation of secondary sulfides of non-ferrous metals from solutions. (3) The millerite forming during leaching oxidizes more slowly than pentlandite. D.L.G.

N70-16997 National Lending Library for Science and Technology, Boston Spa (England).
SOME TERNARY CHALCOGENIDES WITH A CHALCOPYRITE STRUCTURE
H. Hahn et al 28 Jul. 1969 44 p refs Transl. into ENGLISH from Z. Anorg. Allge. Che. (Leipzig), v. 271, 1953 p 153-170
(NLL-RRE-Trans-219-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The compounds CuAlS2, CuAlSe2, CuAlTe2, CuGaSe, CuGaTe2, CuInS2, CuInSe2, CuInTe2, CuTlSe2, AgAlS2, AgAlSe2, AgAlTe2, AgGaS2, AgGaSe2, AgGaTe2, AgInS2, AgInSe2, and AgInTe2 were obtained by means of reaction of the binary components at high temperatures. All the compounds crystallize in the chalcopyrite type structure (CuFeS2). CuTlSe2 and AgInS2 are dimorphous. In the case of AgInS2 the chalcopyrite structure changes over to wurtzite or else, a wurtzite-like structure above 600 C. CuTlSe2 crystallizes below 250 C in a chalcopyrite lattice. The formation of the chalcopyrite structure in these compounds is explained by the strong tendency of elements of adjacent groups to the forming of atomic combinations with tetrahedral do-ordination as opposed to the chalcogenes. Author

N70-17010# Dayton Univ., Ohio. Research Inst.
THE ENHANCEMENT OF THE 6 P(7/2) FLUORESCENCE OF GD(3+) IN SR F2 CONTAINING CE(3+) AS A CODOPANT Technical Report, 1 Jan. 1967 - 1 Jul. 1969
James L. Wolf and Perry P. Yaney Aug. 1969 87 p refs
(Contracts F33615-69-C-1172; AF 33(615)-3793)
(AD-697069; UDRI-TR-69-34; AFML-TR-69-232) Avail: CFSTI CSCL 20/12

In this report the influence of an additional impurity ion, Ce(3+), on the 6P(7/2) fluorescence of Gd(3+) in SrF2 is examined. Seven samples containing 0.1 mole percent Gd(3+) and different concentrations of Ce(3+) ranging from 0.01 to 1.0 mole percent were studied. The enhancement of the Gd(3+) fluorescence observed for increasing Ce(3+) concentration is attributed to non-radiative energy transfer between Ce(3+) and Gd(3+). Relative quantum efficiencies of transfer are reported for the spectra associated with both excitations. The quantum efficiency of transfer for 2500 A excitation is an order of magnitude higher than that for 2750 A. The spectrum observed under 2750 A excitation is predominantly that of the tetragonal site. However, the spectrum observed under 2500 A excitation is previously unobserved. It is tentatively identified as a monoclinic site. The relatively high quantum efficiency of transfer and the proposed model for the symmetry site (monoclinic) observed under 2500 A excitation suggest exchange as the dominant mechanism of transfer. The transfer mechanism for the sites involved in the spectrum observed under 2750 A excitation cannot be identified from this data, although it is probably some combination of multipolar transfer mechanisms.
Author (TAB)

N70-17013# California Univ., La Jolla. Dept. of Chemistry.
NMR MEASUREMENTS OF PROTON EXCHANGE IN AQUEOUS THIOUREA
R. L. Void and Adolfo Correa 12 Nov. 1969 22 p refs
Submitted for publication
(Contract N00014-67-A-0109-0014)
(AD-696744; TR-1) Avail: CFSTI CSCL 7/4

The semiclassical lineshape expression of Hahn, Maxwell and McConnell for chemical exchange between two unequally populated sites is extended to the case where spin 1/2 nuclei in one site are coupled to a relaxing nucleus of spin I. The lineshape expression is written in closed algebraic form for spin I = 1 and I = 3/2. Experimental results are reported for acid catalyzed protolysis of aqueous thioures. Possible exchange reactions are discussed. Water linewidths are used to derive rate parameters. The rate law for acid catalyzed protolysis of aqueous thioures was found. Protolysis of thiourea N-H protons is concluded to be catalyzed about 60 times more efficiently than N-methyl acetamide N-H protons.
Author (TAB)

N70-17050# Naval Research Lab., Washington, D.C. Analytical Chemistry Branch.
PROCEDURES FOR THE ANALYSIS OF METALS, ALLOYS, AND OTHER MATERIALS OF RESEARCH. PART 4: SPECTROPHOTOMETRIC PROCEDURES FOR THE DETERMINATION OF IONS FORMED WITHIN STRESS-CORROSION CRACKS Progress Report
O. R. Gates 7 Oct. 1969 15 p refs
(AD-696937; NRL-6948-Pt-4; PR-4) Avail: CFSTI CSCL 7/4

Working at final volume levels as low as 3 ml, spectrophotometric procedures have been developed for the determination of very small amounts of ferrous, ferric, and alloying-constituent ions formed within stress-corrosion cracks in carbon steels and in steels containing nickel, chromium, molybdenum, and manganese, respectively.
Author (TAB)

N70-17077# Physics Technology Labs., Inc., La Mesa, Calif.
NEUTRAL ATOMIC NITROGEN AND OXYGEN BEAMS Final Report, 1 May 1968 - 30 Apr. 1969
Arthur T. Stanley 30 May 1969 50 p refs
(Contract F19628-68-C-0281)
(AD-696099; AFCRL-69-0239) Avail: CFSTI CSCL 7/4

The report covers design, development, fabrication and test of a sputtered neutral atomic beam system consisting of beam source, mechanical velocity selector, ionizer and mass spectrometer. Prime accomplishments were improved performance and simplified designs when compared to previous developments and investigation of generated beams to ascertain constituent particles, densities and energy distributions. The report concludes that: (a) Test and calibration verified proper function of all subassemblies and successful integration of all components into one system to produce velocity selected neutral beams. (b) Experiments with copper revealed that sputtering can produce neutral beams of both simple atomic species and complex molecular structure, depending upon the nature of the target and its relation to other sputtering parameters. (c) Recorded mass spectra confirm the existence of sputtered neutral atomic nitrogen and oxygen. However, no direct density measurements were made. (d) The developed theoretical model, verified by independent experiment, demonstrates that the maximum possible neutral atomic nitrogen beam produced under the conditions imposed, had a density of 0.65 x 10 to the 15th power particles/sec.
Author (TAB)

N70-17083# Ledoux and Co., Teaneck, N.J.
ANALYTICAL TECHNIQUES FOR THE COMPOSITIONAL ANALYSIS OF REFRACTORY METALS AND COMPOUNDS Summary Technical Report, 1 Apr. 1967 - 31 Dec. 1968
S. Kallmann, E. Hobart, R. Conradi, B. Kazanjian, J. Wieland et al.
Oct. 1969 21 p refs
(Contract F33615-67-C-1524)
(AD-697068; AFML-TR-69-103) Avail: CFSTI CSCL 7/2

The report summarizes research aimed at devising and applying analytical chemical methods to refractory materials of interest to the Air Force. A simplified version of effluent gas analysis was investigated for application to a variety of refractory carbides. Experimental difficulties led to abandonment of the approach. A new method for determining nitrogen in refractory metals was devised and applied to various samples. Refractory metals were found to be dissolved readily by a mixture of HF-H3PO4 and K2Cr2O7. The nitrogen in such samples is converted to ammonium salts, readily distilled and measured with good sensitivity by the indophenol blue photometric method. The sensitivity of the dithiol method for determining tungsten and molybdenum in niobium and tantalum has been improved by use of a preliminary solvent extraction procedure to remove the bulk of tantalum or niobium from large samples. A modified counter-current extraction technique using the 6M HCl-2.4M HF and methyl isobutyl ketone system has been devised for determining as little as 5 ppm of tungsten in molybdenum. A new gravimetric system for determining major quantities of cobalt has been divised. Cobalt oxalate (CoC2O4.2H2O) is easily precipitated and dried to a constant composition containing 32.22% of cobalt. This technique is simpler and more accurate than the conventional electrolytic method.
Author (TAB)

N70-17092# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
ELECTRONIC SPECIFIC HEAT OF VANADIUM CHROMIUM HYDRIDE
David Rohy and R. M. Cotts Jul. 1969 18 p refs
(Rept-1192) Avail: CFSTI

Electronic specific heat coefficients, gamma, have been measured for five samples of the ternary alloy system. Results on two samples with y = 0 agree with known values of gamma for V sub 1-xCr sub x alloys. All hydride samples have a decrease in gamma compared to nonhydride samples. The plotted points for hydride and nonhydride samples fall very close to a single curve of gamma vs (e/a), the electron per atom ratio, when (e/a) is determined by (e/a) = 5(1-x)+6+y. Results indicate that the rigid band model is useful in qualitative interpretation of the effects of hydriding transition metals. The fact that gamma depends upon

(e/a) and not upon relative amounts of Cr or H supports the concept that the hydrogen atom contributes its electron to the host metal conduction band. Author

N70-17095# Dayton Univ., Ohio. Research Inst.
EPR SPECTRA OF GD(3+) IONS IN GD(3+): MeF2 CRYSTALS Technical Report, 1 Jul. 1967 - 1 Jul. 1969
Thomas P. Graham Aug. 1969 20 p refs
(Contracts F33615-69-C-1172; AF 33(615)-3793)
(AD-697038; UDRI-TR-69-33; AFML-TR-69-231) Avail: CFSTI CSCL 20/12

The Gd(3+) Electron Paramagnetic Resonance (EPR) spectra has been investigated in the series of MeF2 (Me = Ca, Sr, Ba) crystals. The site symmetry and crystal field coefficients in the spin Hamiltonian have been determined in a number of cases. A description of a computer program under development to aid in analysis is included. Author (TAB)

N70-17098# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
THEORY OF DIELECTRIC RELAXATION IN POLAR LIQUIDS
Tsu-Wei Nee (Arizona Univ.) and Robert Zwanzig Sep. 1969 54 p refs
(Contract N00014-67-A-0239-0002)
(AD-696984; BN-622) Avail: CFSTI CSCL 7/4

The theory of dielectric relaxation in a model polar liquid is developed and applied to experimental data. The model is a spherical Onsager cavity, with a uniform dielectric background described by the high frequency limit dielectric constant, and containing a permanent point dipole. The dipole moment undergoes rotational Brownian motion in the cavity. Dielectric friction on the rotating dipole is taken into account, and leads to a frequency dependent relaxation time. Earlier theoretical results, obtained first by Klug, Kranbuehl, and Vaughn, and by Fatuzzo and Mason, are rederived. When the rotational Brownian motion is spherically isotropic, approximate Debye relaxation is found. When the rotational Brownian motion of the dipole is restricted to a constant angle with respect to some fixed axis, approximate Davidson-Cole relaxation is found. Experimental data on glycerol and i-amyl bromide are analyzed this way. Author (TAB)

N70-17147# Wisconsin Univ., Madison. Dept. of Chemistry.
THERMOLYSIS STUDIES OF GROUP 4 DERIVATIVES OF PENTABORANE(9) Technical Report, 1 Oct. 1968 - 30 Sep. 1969
Donald F. Gaines, Terry V. Iorns, Jeffrey Ullman, and Elna Clevenger 2 Oct. 1969 8 p refs
(Contract N00014-67-A-0128-008)
(AD-696993; TR-1) Avail: CFSTI CSCL 7/2

The report concerns the thermolysis products obtained from Group IV derivatives of pentaborane of the general type R3M(IV)B5H8 (where R = H or CH3, and M(IV) = Si or Ge). Significant yields of CB5H9 are isolated from thermolysis of (CH3)3GeB5H8. Direct gas phase reaction of GeH4 with B5H9 produces 2-H3GeB5H8. Author (TAB)

N70-17150# Rochester Univ., N.Y. Dept. of Chemistry.
THE PYROLYSIS OF ETHYLCYCLOBUTANE IN THE GAS PHASE AT HIGH PRESSURES Final Scientific Report
James Aspden, Nazir A. Khawaja, Joseph Reardon, David J. Wilson, and W. D. Walters Nov. 1969 19 p refs
(Grant AF-AFOSR-575-66)
(AD-697082; AFOSR-69-2878TR) Avail: CFSTI CSCL 7/4

Theoretical work in the field of unimolecular reactions raises some doubt whether or not high pressure limits to unimolecular rates do exist. The objective of the work was to study the unimolecular decomposition of some alkyl-substituted cyclobutanes at pressures as high as two hundred atmospheres, using nitrogen as a diluent gas, in an attempt to determine if the proposed limits actually exist. Small partial pressures (twenty to fifty mm Hg) of ethylcyclobutane were mixed from one hundred to four thousand psi of oxygen-free nitrogen and pyrolyzed at approximately four hundred ten degrees centigrade. Analyses were done on a Varian Aerograph six hundred D chromatograph with flame ionization detection. Despite serious experimental problems the search was successful and the predicted decrease of the rate constant was observed and verified. Measurements of this sort can provide kineticists with a new type of information about the nature of the transition state in unimolecular gas reactions. Author (TAB)

N70-17232# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
STEREOSPECIFIC INHIBITION OF HYDROLYTIC ENZYMES BY ASYMMETRIC ORGANOPHOSPHORUS COMPOUNDS-4. THE REACTION OF ACETYLCHOLINESTERASE AND BUTYRYLCHOLINESTERASE WITH ISOPROPYL S-2-SUBSTITUTED ETHYL METHYLPHOSPHONOTHIOATES [STEREOSPECIFIEKE REMMING VAN HYDROLYTISCHE ENZYMEN DOOR ASYMMETRISCHE FOSFORVERBINDINGEN. 4. DE REACTIE VAN ACETYLCHOLINESTERASE EN BUTYRYLCHOLINESTERASE MET ISOPROPYL S-2-GESUBST. ETHYL METHYLFOSFONTHIOATEN]
H. L. Boter Aug. 1969 15 p refs
(TDCK-54275; Rept-1969-17) Avail: CFSTI

Bimolecular rate constants for the irreversible inhibition of acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE) by enantiomeric forms of some isopropyl S - 2 - substituted ethyl methylphosphonothioates were determined. The substituents were chosen in such a way that a large range of anticholinesterase activities was covered. On the whole AChE is substantially more stereospecific than BuChE. The stereospecificity of AChE runs parallel with the inhibitor activity, whereas that of BuChE is almost independent of the inhibitor potency. The difference in stereospecific behaviour of the esterases is attributed to more stringent steric requirements of the active site in the case of AChE. The high stereospecificity of AChE was used to estimate the optical purities of the (+) - isomers of four members of the series. Author

N70-17235# Iowa Univ., Iowa City. Dept. of Chemistry.
PREPARATION, REACTIONS AND STRUCTURES OF TRANSITION METAL OLEFIN COMPOUNDS AND RELATED SUBSTANCES Final Report, 1 Jan. 1965 - 1 Jul. 1969
N. C. Baenziger and J. R. Doyle Oct. 1969 13 p refs
(Grants AF-AFOSR-763-65; AF-AFOSR-763-67)
(AD-697039; AFOSR-69-2832TR) Avail: CFSTI CSCL 7/3

A summary of work performed during the four year grant period is outlined. Major areas involved in the acquisition of new knowledge were: (1) The structures of metal-olefin compounds containing silver, palladium and iron; (2) New olefin complexes of silver and copper; (3) New managanese and rhenium carbonyl complexes and containing nitriles and aromatic ligands. (4) A systematic examination of the n.m.r. spectra of platinum and palladium olefin compounds; (5) A kinetic study on the solvolysis of platinum and palladium compounds. (6) New complexes of triphenylphosphine gold compounds involving a periodic valence states of gold; (7) A study of the thermal motion of CS2 in the solid state and its relation to the motion of the olefin group in metal-olefins. Author (TAB)

N70-17237# California Univ., Berkeley.
EFFECT OF CATALYSTS ON THE DEFLAGRATION RATE OF AMMONIUM PERCHLORATE Interim Report, 1 Jul. 1968 - 30 Jun. 1969
E. E. Petersen 30 Jun. 1969 78 p refs
(Grant AF-AFOSR-1458-68)
(AD-697043; AFOSR-69-2940TR) Avail: CFSTI CSCL 7/4

The burning rates of polycrystalline pellets of ammonium perchlorate from three sources and with different degrees of recrystallization (Degree of recrystallization is used to mean the

number of times ammonium perchlorate is successively recrystallized) were measured and compared. The burning rate changed considerably in the first three successive recrystallizations and the data showed that the impurities affected the burning rate especially at high pressures. It was also found that occluded water in ammonium perchlorate pellets changed the deflagration rate considerably. These results indicate that one of the reasons for the disagreement among different investigators on the burning rate of ammonium perchlorate might well be the effect of traces of residual impurities which existed in the crystals and pellets used in the studies even after purification by recrystallization. The present study also indicates that the nature of impurities in the as received or recrystallized ammonium perchlorate depends on the source of supply. It was also found that pressing uniform pellets of reproducible quality is very difficult. Considerable experimental evidence exists which indicates that the distribution of catalyst has relatively little effect on its performance. To understand better the important parameters needed to explain the experimental data, a theoretical study was carried out. A mathematical model was developed to calculate the effectiveness factor for surface reactions coupled with surface diffusion on a solid-catalyst surface or bulk diffusion near the burning surface, with discrete adsorption centers. The solutions for integral-order reactions are presented. Author (TAB)

N70-17247# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

SYNTHESIS AND CRYSTALLOGRAPHIC STUDY OF THE COMPOUNDS IN THE CS SUB 2 O AI SUB 2 O SUB 3 SiO SUB 2 SYSTEM [SYNTHESE ET ETUDE CRISTALLOGRAPHIQUE DES COMPOSES DU SYSTEME CS SUB 2O/AL SUB 2O SUB 3/SIO SUB 2]

Gerard Langlet Sep. 1969 156 p refs In FRENCH; ENGLISH summary

(CEA-R-3853) Avail: CFSTI

The preparation, structure, and thermal evolution were investigated of definite compounds in the system Cs2O-Al2O3-SiO2 The purpose was to find a compound which would be insoluble, refractory, and at the same time able to contain radioactive isotopes of cesium, and thus be suitable as a radiation source. The compound which seems quite convenient for this use, Cs2AlSi2O6, is closely related to the natural mineral pollucite. Author (ESRO)

N70-17279# Naval Research Lab., Washington, D.C.

MECHANISM OF THE FORMATION OF SUPERRADIANCE IN PULSED DISCHARGE IN NEON AND ARGON [MEKANIZM VOZNIKNOVENIYA SVERKHSVETIMOSTI PRI IMPULSNOM RAZRYADE V NEONE I ARGONE]

A. A. Isaev et al 20 Nov. 1968 7 p refs Transl. into ENGLISH from Elektronnaya Tekhn., Ser. 3: Gagorazryadnyye Pribory (USSR), no. 3, 1967 p 17-21

(AD-696877; NRL-Trans-1155) Avail: CFSTI CSCL 7/4

Superradiance in pulsed discharge in neon and argon has been investigated. A new line of superradiance in neon was discovered at 6266 A (transition 2 P5-1 S3). The dependence of superadiance on the neon pressure and voltage in the tube is investigated. It is shown that the basic mechanism of creating inversion in 2 P-1 S transitions in neon is stepwise excitation by electrons. Three new lines of superradiance were discovered in argon. Author (TAB)

N70-17287# Clevite Corp., Cleveland, Ohio. Electronic Research Div.

RESEARCH ON IMPROVED II-VI CRYSTALS

L. R. Shiozawa and J. M. Jost Jul. 1969 76 p refs

(Contract F33615-68-C-1601)

(AD-694533; ARL-69-0107) Avail: CFSTI CSCL 7/4

Accurate vapor pressure equations and the relevant vapor compositions of Zn, Cd, S, Se, and Te have been established over a wide temperature range. The phase diagrams of the Zn-S, Cd-S, Zn-Se, Cd-Se, Zn-Te, and Cd-Te systems are presented. Reasonably accurate equations for the equilibrium constants of sublimation of ZnS, CdS, ZnSe, CdSe, ZnTe, and CdTe have also been established. Component pressures at the solid stability field boundaries of CdS have been experimentally determined, supplementing earlier determinations for CdSe and ZnTe. The compositions at the solid stability field boundaries have been tentatively evaluated for CdS and compared to those of ZnTe derived earlier. Some special topics related to growth and treatment of crystals are also discussed. Author (TAB)

N70-17349*# Pennsylvania State Univ., University Park. Dept. of Materials Science.

CARBONS PRODUCED FROM KNOWN ORGANIC COMPOUNDS 2. ANTHRACENE-BIPHENYL AND PHENANTHRENE-BIPHENYL SYSTEMS

A. Weintraub and P. L. Walker, Jr. [1969] 28 p refs

(Grant NGL-39-009-015)

(NASA-CR-107851) Avail: CFSTI CSCL 07C

Binary mixtures (systems) of typical graphitizable and nongraphitizable hydrocarbons were carbonized and heat treated to study the graphitizability of the resulting carbons. The hydrocarbons selected were anthracene, phenanthrene, and biphenyl. The first two are isomers and are highly graphitizable, while biphenyl is nongraphitizable. Carbonizations were carried out in a pressure vessel containing either anthracene--bihpenyl or phenanthrene--biphenyl mixtures at 73-98 atm and 550 C. The carbons were studied by optical microscopy, X-ray diffraction, helium density, and electrical resistivity measurements. For the anthracene--biphenyl system, carbons of homogeneous texture were not produced, rather fractions of highly graphitic and poorly graphitic carbons were obtained. For the phenanthrene--biphenyl system, carbons which are more homogeneous on a macroscale were produced, their graphitic character decreasing sharply as the amount of biphenyl in the original mix was increased. Author

N70-17435# Centro Brasileiro De Pesquisas Fisicas, Rio De Janeiro.

RADIOCHEMICAL APPLICATIONS OF THE MOESSBAUER EFFECT

J. Danon 1968 55 p refs Presented at the 2nd Interam. Conf. on Radiochem., Mexico City, May 1968 *Its* Notas De de Fisica, v. 14, no. 7

Avail: CFSTI

Observations and calculations of the Mossbauer factor are reviewed, and applications of the Mossbauer effect to radiochemistry are outlined. Applications include: (1) radiolysis of solids, (2) recoil chemistry, (3) surface studies, (4) Mossbauer effect in microcrystals, ion-exchange resins, and solutions, and (5) chemistry and solid state properties of the heaviest elements. A table of isotopes in which the Mossbauer effect has been observed and graphical representations of Mossbauer spectra are included. D.L.G.

N70-17437 National Lending Library for Science and Technology, Boston Spa (England).

GENERAL SURVEY AND FUTURE SCOPE OF THE CHEMISTRY OF QUINACRIDONES

Yoshio Nagai et al 18 Jul. 1969 54 p refs Transl. into ENGLISH from Dyestuffs and Chem. (Japanese), v. 13, no. 3, 1968 p 81-109

(NLL-T-6230-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: .5 NLL photocopy coupons

The compound 6,13-dichloroquinacridone (13, X = Cl) and its 2,9- dimethyl- and 3,10- dichloro-dirivitives were obtained by introducing chlorine molecules in quinacridone compounds. Quinacridonequinone and its derivitives and leucoquinacridonequinone and its derivitives were synthesized. Methods for synthesizing quinacridone using aluminum chloride or polyphosphoric acid and tin, and by reduction techniques are discussed. A synopsis of industrial methods and pigmentation processes employed by various companies throughout the world is included.

N70-17444# Central Electricity Generating Board, London (England). Research and Development Dept.

A REVIEW OF THE REACTION OF CARBON WITH WATER VAPOUR AND HYDROGEN

T. Swan Aug. 1969 31 p refs

(RD/B/M-1297) Avail: CFSTI

Studies of the thermal reactions occurring between carbon and water vapor and carbon and hydrogen are reviewed up to 1968. Information from a variety of sources was collected in an attempt to predict the effect of gamma radiation on these processes and the limited experimental investigations of this effect are described. Author (NSA)

N70-17445# Central Electricity Generating Board, London (England). Research and Development Dept.

A REVIEW OF THE THERMAL EXCHANGE OF ISOTOPES BETWEEN CO AND CO2

A. J. Wickham Jul. 1969 14 p refs

(RD/B/M-1390)

Work on the thermal exchange reactions in the CO/CO2 and associated systems, both in the presence and absence of catalytic surfaces, is reviewed. It is concluded that the reactions that occur in the presence of a carbon surface proceed by a different mechanism from those occurring in the gas phase or in the presence of glass, silica, metal, or oxide surfaces. Reactions in silica or pyrex vessels were shown to occur primarily by dissociative or nondissociative absorption of at least one of the reactants on the surface. At higher temperatures the homogeneous reaction becomes more important, especially in CO/CO2 above 900 C. The kinetics of this system are well understood in situations where interfering surface effects can be eliminated. Author (NSA)

N70-17514# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

SYNTHESIS, AUTOXIDATION AND PHOTOOXIDATION OF HINDERED PYRROLE DERIVATIVES: HINDERED PYRROLIC NITROXIDE RADICALS [SYNTHESE, AUTOXYDATION ET PHOTOXYDATION DE PYRROLES ENCOMBRES: RADICAUX NITROXYDES PYRROLIQUES ENCOMBRES]

Rene Ramasseul (Ph.D. Thesis—Grenoble Univ., 25 Nov. 1968) Oct 1969 116 p refs In FRENCH; ENGLISH summary

(CEA-R-3737) Avail: CFSTI

The sensitized photoxidation of these hindered pyrroles gave corresponding hydroperoxides whose most likely structures were determined by physical and chemical methods. Oxidation of 2,5-di-t-butyl and 2,3,5-tri-t-butyl pyrrole by hydrogen peroxide in the presence of inorganic peradic or by p-nitroperbenzoic acid did not give pyrrolic nitroxides in contrast with secondary amines. Some N-hydroxypyrroles were then prepared from pinacoline and ethyl pivaloylacetate. Their oxidation by lead dioxide gave the corresponding pyrrolic nitroxides. 2,5-di-t-butyl 3,4-diethoxycarbonyl pyrryl 1-oxy was isolated and studied spectroscopically (visible and UV, EPR). In marked contrast with ordinary nitroxides it does not show the solvent effect and can be compared with 2,4-di-t-butyl cyclopentadienone, a carbon analog. For both, the long wave length transition does not show the usual n-pi behaviour as confirmed by EPR. Use of Huckel's method for pyrrolic nitroxide skeleton made it possible to interpret the experimental data satisfactorily. Author (ESRO)

N70-17518# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

QUANTITATIVE ANALYSIS OF ROCKS BY X-RAY FLUORESCENCE. PART 1: THE IMPORTANCE OF SCATTER X-RADIATION FOR CALIBRATION

K. Weber (Technische Univ., Berlin) Brussels Nov. 1969 42 p refs

(EUR-4387.F-Pt-1) Avail: CFSTI

An equation is established between the absorption coefficient of a specimen and the intensities of coherent and incoherent scattered X-rays. Using a standard (Al2O3), this equation is largely independent of the spectrometer type used. The derived equation is strictly valid only for binary systems but also gives good results for specimens of different composition (silicate, carbonate rocks) and the standard error remains within the limit of + or - 5%. The method discussed can be used for the quantitative determination of the chemical elements of Z greater than or equal to 27 with higher precision. In addition, it is demonstrated that a subsequent calculation of the scattered intensity may serve for verification of the analysis performed. Author

N70-17555# California Univ., Livermore. Lawrence Radiation Lab.

SPECTROPHOTOMETRIC STUDY OF THE COMPLEXES OF CERIUM AND URANIDES WITH DIETHYLENETRIAMINEPENTAACETIC ACID [CONTRIBUTION A L'ETUDE DE LA COMPLEXATION DU CERIUM ET DES URANIDES PAR L'ACIDE DIETHYLENETRIAMINEPENTAACETIQUE (DTDA)]

Mohamed Badreldin Hafez (Ph.D. Thesis—Paris Univ., 6 Mar. 1968) Jul. 1969 98 p refs Transl. into ENGLISH from French Report No. CEA-R-3521

(UCRL-Trans-10366; CEA-R-3521) Avail: CFSTI

A spectrophotometric determination was made of the complexes of cerium and uranides (uranium, neptunium, plutonium, and americium) in their different degrees of oxidation with diethylenetriaminepentaacetic acid. Two physicochemical states, the ionic and hydrolysis ones, were considered. In the former case, the influence of the pH on the formation of the complex was studied, and whenever the complexes were stable, the molecular ratio was determined and their stability constants were calculated. In the latter case, the conditions of solubilization of the precipitation were studied by formation of complexes soluble in water as a function of pH, age of the precipitate, and time of precipitate chelate contact. Author

N70-17566# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

PHOTOELECTRON SPECTROSCOPY [SPECTROSCOPIE DES ELECTRONS]

Annick Lemarechal-Dupuis Oct. 1969 18 p refs In FRENCH; ENGLISH summary

(CEA-BIB-158) Avail: CFSTI

The spectroscopy of photoelectrons is a method of investigating atomic and molecular ionization potentials. The principle of the method, the various types of apparatus used and the most typical examples of known spectra are reviewed. Author (ESRO)

N70-17569# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE STUDY OF THE CHEMICAL CONSEQUENCES OF THE (N, GAMMA) REACTION IN SOLID CO(III) TRIS-ACETYLACETONE [CONTRIBUTION A L'ETUDE DES CONSEQUENCES CHIMIQUES DE LA REACTION (N, GAMMA) DANS LE TRIS-ACETYLACETONATE DE COBALT(III)]

Ruy Magnane Machado (Ph.D. Thesis—Grenoble Univ., 28 Nov. 1968) Jul. 1969 66 p refs In FRENCH; ENGLISH summary

(CEA-R-3786) Avail: CFSTI

The fragmentation and annealing of thermal neutron irradiated Co(III) tris-acetylacetone was investigated using the thin layer chromatographic technique (silicagel 1 mm thickness). Low temperature irradiations (0 C, - 72 C and - 180 C) lead to Co-60 retentions as low as (1.1 + or - 0.2) per cent. Annealing by linear temperature programming at different heating rates has shown the existence of eight reactions. The influences of pile dose and of gases (air and helium) as well as of thermal decomposition of the annealing processes were confirmed. A temperature and dose dependent effect was found out for the retentions of the Co-60m and Co-60 isomers. Author (ESRO)

N70-17586# Kiev Univ. (USSR).
X-RAY ABSORPTION OF IRON-GROUP METALS IN THEIR BORIDES
S. M. Karalnik, E. T. Kachkovskaya, and A. B. Lyashchenko *In* Akad. Nauk Investigating The Electron. Properties of Metals and Alloys 1967 p 92-96 refs In RUSSIAN (See N70-17576 06-17)
Avail: CFSTI

Iron-group borides were investigated to characterize their bonding mechanisms under various conditions. The size of displacement of the K-boundary of transition metals in all cases has a positive sign. This is larger in those compounds in which the nonmetal possesses a large value for electrical negativity. A large value for the K-boundary displacement of the metal corresponds to a higher melting temperature, a larger modulus of elasticity, and a higher heat of formation. This indicates that the values for displacement are completely in agreement with the degree of interatomic bonding in various compounds, since all the attraction characteristics are always higher for substances with a stronger bond. A relatively large displacement in borides of the K-boundary corresponds to the view that transition metals fill their 3d-shells more readily when the first half of the vacancy is filled. Transl. by H.W.

N70-17587# Akademiya Nauk URSR, Kiev.
X-RAY EMISSION SPECTRUM OF COBALT IN SILICIDES
V. P. Tsvetkov, N. D. Savchenko, and A. V. Kalenichenko *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 97-102 refs In RUSSIAN (See N70-17576 06-17)
Avail: CFSTI

The displacement of the emission lines of cobalt in silicides is considered. Comparison of shape and energy positions of cobalt K Alpha 1 and K Alpha 2 lines in various compounds shows that the interdoublet distance in pure metals and in compounds remains unchanged. Studying the energy position and shape of the K Beta 5 band shows that the displacement of the intensity maximum takes place for CoSi2 and CoSi on the short-wave side in relation to its position in the metal and that of Co2Si on the long-wave side. These phenomena cannot be explained by any one type of model. The relative intensity of the K- and L-bands must be further studied as well as the three-dimensional distribution of the electron density in the lattices of silicides. Transl. by H.W.

N70-17627 National Lending Library for Science and Technology, Boston Spa (England).
TERNARY CHALCOGENIDES OF ALUMINUM, GALLIUM AND INDIUM WITH ZINC, CADMIUM AND MERCURY
H. Hahn et al 28 Jul. 1969 38 p refs Transl. into ENGLISH from Z. Anorg. Allge. Che. (Leipzig), v. 279, no. 5-6, 1955 p 241-270
(NLL-RRE-Trans-220-(8036.625) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

Ternary chalcogenides were produced in the solid state by means of reactions, at high temperatures, and studied by X-ray. All the structures studied had an almost cubically dense packing of the chalcogenide atoms, in whose tetrahedral holes the metal atoms of the space group concerned are correspondingly distributed. the preferred formation of the chalcopyrite or zinc blend-like structures as opposed to the spinal structure, was explained for the compounds studied here, by the strong tendency of the B-group elements to form atomic relationships with tetrahedral co-ordination, with respect to the non-metal atoms. Some rules on the preferred formation of one of the two spinel structures were deduced, with the results obtained from experiments as a guide, and tested on the compounds already known with spinel structure. Author

N70-17631 National Lending Library for Science and Technology, Boston Spa (England).
CATION SEPARATION BY SOLVENT EXTRACTION
H. Forster et al [1969] 15 p refs Transl. into ENGLISH from Anal. Chim. Acta (Amsterdam), no. 45, 1969 p 511-523
(NLL-M-7758-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A simple and rapid cation separation scheme has been developed, covering about 60 cations, many of them being quantitatively separable in the micro- and milligram ranges. By analogy with the classical hydrogen sulfide a monia separation process, the cations are divided with decreasing acidity by BPHA and DDDC extraction into five main groups. In group I the transition elements of groups IV to VII of the periodic system are extracted from 2N mineral acidic solution, as BPHA complexes; in group II, from the same acid concentration, cations of the hydrogen-sulphide group are extracted by DDDC; and in group IV, from 1N ammoniacal solution are extracted the alkaline earths as BPHA complexes. For further separation, the differing re-extractability of these chelate complexes dissolved in chloroform with solutions of reagents is utilized. Author

N70-17658*# Pennsylvania Research Associates, Inc., Philadelphia.
ADVANCED FUEL CELL CATALYSTS Status Report, 10 Aug. 10 Nov. 1969
Carlo V. Bocciarelli 10 Nov. 1969 36 p refs
(Contract NAS7-574)
(NASA-CR-107879; EC-SR-10) Avail: CFSTI CSCL 07D

The single-crystal, 250 micron balls are first ground in an aluminum oxide mortar under glycerol for 72 hours at room temperature in air, then further ground in an attritor ball mill with glycerol 80% and distilled water 20% for 72 hours at room temperature in air. Using a calibrated reticle in the optical microscope we estimate the final particle diameter at .5 micron and less. The output after grinding to be about 150 grams per 40-hour week. The new method was used to prepare about 250 grams of catalyst, samples including eleven gold-copper alloys (pure or doped with 10, 15, or 22 at-% In, Ga or Al) and three silver powders (one pure, two doped with 10 at-% Al). Depending on their average size, the powders varied in color from light tan to blacks. Electrodes constructed with all but the black powders were inferior in performance as compared with our earlier preparations. A simple analysis has shown the importance of removing coarse particles, if maximum activity is to be obtained. Author

N70-17662# Gulf General Atomic, San Diego, Calif.
COLLISIONS BETWEEN GAS ATOMS AND SURFACES Annual Summary Report 1, Oct. 1968 - 30 Sep. 1969
J. N. Smith, Jr. 30 Sep. 1969 104 p refs
(Contract F44620-69-C-0034)
(AD-697083; GA-9619; AFOSR69-2939TR) Avail: CFSTI CSCL 7/4

Experimental results of studies of molecular beam scattering from surfaces obtained during the period 1 October 1968 to 30 September 1969, are presented. Major emphasis was on the scattering of the rare gases and hydrogenic molecules from (001) LiF and included studies of diffraction, selective adsorption, and the effects of normal lattice modes and elastic properties on the scattering. Included are three articles which have been submitted for publication. The titles of these are the following: An experimental attempt to observe diffraction from (001) Ag; Intensity data for the reflection and diffraction of 3He, 4He, H2 and D2 from the (001) surface of LiF; Rare gas scattering from LiF-Correlation with lattice properties II. TAB

N70-17665 South Carolina Univ., Columbia.
ELECTROCHEMICAL INVESTIGATIONS USING THE POLAROGRAPHIC TECHNIQUE OF KALOUSEK
William Frank Kinard (Ph.D. Thesis) 1968 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-5802

The Kalousek square-wave polarographic techniques were investigated using a modern electrochemical instrument design

based on operational amplifier circuitry. The inherent sensitivity of the K-1 and K-2 techniques for reversible systems were presented along with special analyses that could not be performed by conventional polographic methods. The analysis of a reversibly reduced system in the presence of an irreversibly reduced species at the same potential was demonstrated in the case of the cadmium(II)-europium(III) reductions. The K-2 technique was used to analyze a system that was reduced beyond the hydrogen discharge wave. In addition, the utility of the K-1 technique in the analysis of the reversibly reduced alkali metal ions was also demonstrated. Dissert. Abstr.

N70-17867 Rensselaer Polytechnic Inst., Troy, N.Y.
STUDIES ON RHENIUM: CHARACTERIZATION OF COMPLEXES FORMED IN FUSED MEDIA
Steven Lloyd Kozak (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-6467

A new technique which utilizes a molten salt or fused organic reaction medium for the syntheses of homogeneously substituted complexes of rhenium was developed. The method appears extensible to other heavy metal elements. All complexes prepared were characterized by infrared, visible, and ultraviolet spectroscopy, as well as magnetic susceptibility measurement. Bonding modes were established for all complexes. Employing the melt technique, the hexathiocyanatorhenates (IV) and (V) were synthesized. These appear to be bonded through the sulfur atom of the ligand. The identity of the colored species which has served as the basis of the colorimetric test for rhenium was positively established to be the hexathiocyanatorhenate(IV) ion. It was found that sizable quantities of the rhenium(V) analog form in the absence of excess reducing agent leading to significant errors in the analytical results. Dissert. Abstr.

N70-17677 Pennsylvania Univ., Philadelphia.
THE CONTROLLED-POTENTIAL ELECTROLYSIS STUDY OF THE KINETICS OF THE HEXAAMMINE-RUTHENIUM(III)PERCHLORATE REACTION
James Edward Munz (Ph.D. Thesis) 1968 149 p refs
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-5650

The kinetics of the reduction of perchlorate ion by hexaammineruthenium(II) were investigated using controlled-potential electrolysis. The end products of the reaction are chloride ion and trivalent ruthenium species. It was found that the rate-determining step was the conversion of the hexaammine species to the pentaammine. The ruthenium(II) species were also found to reduce both hydrogen ion and water, trivalent ruthenium again being produced. Values for the specific rates of the several reactions were determined. Dissert. Abstr.

N70-17713 Texas Univ., Austin.
PHASE EQUILIBRIUM IN THE PROPANE-PROPYLENE-WATER SYSTEM IN THE THREE-PHASE REGION
Normantas Klausutis (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $6.20/ Microfilm $3.00 Order No. 69-6169

Experimental phase equilibrium data were determined for the propane-propylene--water system in the three-phase region at temperatures ranging from 100 F to the three-phase critical locus, and pressures for which the three phases coexist. The three coexisting phases were hydrocarbon-rich liquid, hydrocarbon-rich vapor, and water-rich liquid. Compositions of the three equilibrium phases were determined at 100, 130, 160, 190, 200, and 203 F and at pressures for which the three phases coexisted. The water content of the hydrocarbon-rich phases was determined by the use of electrolytic cells. Relative amounts of the hydrocarbon components were determined by Gas Chromatography. The effect that the presence of water has on the vapor-liquid equilibrium of the propane-propylene system was determined, and equilibrium ratios were calculated in order to quantitatively describe this effect. Dissert. Abstr.

N70-17723# Centro Brasileiro de Pesquisas Fisicas Rio de Janeiro
IMPORTANCE OF PI-BONDING IN THE STABILITY OF THE IRON-GROUP CYANIDES
A. A. Gomes, J. Danon, and L. Iannarella 1968 9 p refs *Its* Notas de Fisica Vol. 14, No. 9
Avail: CFSTI

Orthogonality conditions for M. O's provide a unique choice in calculating the energy levels of cyanide complexes using a two level problem corrected by a perturbation due to the third relevant level. Author

N70-17757 Texas Christian Univ., Fort Worth.
POLYMER STUDIES BY GEL PERMEATION CHROMATOGRAPHY
James Aubrey May, Jr. (Ph.D. Thesis) 1968 142 p refs
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order no. 69-6602

In order to determine if quantitative molecular weight distributions could be obtained from gel permeation chromatography (gpc), experimental distribution curves obtained by using gpc were compared with calculated distributions based on kinetic data and Flory's most probable distribution. Samples of polystyrene and poly(methyl methacrylate) were prepared under conditions previously investigated in the literature. The agreement between the experimental and the calculated distributions, as well as the agreement between molecular weights obtained by solution viscometry and gpc, indicated the utility of the gpc technique to study the details of vinyl polymerizations. Until recently, it has usually been easier to determine the appropriate rate terms and to calculate molecular weight distributions rather than to suffer the difficulties and uncertainties of an experimental measurement of a molecular weight distribution. The advent of gpc offered a rapid and potentially accurate method for determining molecular weight distributions. Dissert. Abstr.

N70-17874 Houston Univ., Tex.
THEORETICAL INVESTIGATION AND CORRELATION OF MOLECULAR PARAMETERS OF POLYCYCLIC AROMATIC HYDROCARBONS
Henry Adolph Germer, Jr. (Ph.D. Thesis) 1968 321 p
Avail: Univ. Microfilms: HC $14.65/Microfilm $4.15 Order No. 69-5367

The first part of the theoretical investigation is an interpretation of the calculated singlet electronic transitions of five pentacyclic aromatic hydrocarbon molecules in terms of composite system approximations. This study is motivated by the experimental observation that the electronic transitions of some pentacyclic aromatic hydrocarbons may be, on the basis of extinction coefficients, vibrational structure, and general band shape, correlated with the transitions of tetracyclic aromatic hydrocarbons contained within the structure of the pentacyclic. In this molecules in molecule investigation, the electronic transitions of the five pentacyclic aromatic hydrocarbons are first calculated using the semiempirical SCFMO method with limited configuration interaction. Composite system models or approximations are formed for each pentacyclic hydrocarbon by conceptually breaking certain pairs of bonds in the subject molecule. Dissert. Abstr.

N70-17876# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE REACTION OF DIOXYGEN DIFLUORIDE WITH HIGHER FLUORIDES OF CERTAIN ELEMENTS
D. V. Bantov et al 22 Aug 1969 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Sibir. Serv. Khim. (Moscow), no. 1, 1968 p 84-87

(AD-696234; FTD-MT-24-149-69) Avail: CFSTI CSCL 7/2

The reactivity of dioxygen difluoride O2 F2 with Cl F3, Sb F5, BF3, Sn F4, Mo F6, WF6, and Si F4 has been studied. Dioxygen difluoride was prepared by passing a mixture of fluorine and oxygen through an electric glow discharge in the apparatus shown. The pure O2 F2 was an orange solid melting at 109.7 degrees K, thermally unstable and decomposing to oxygen and fluorine in the neighborhood of the boiling point 216 K. The reaction of O2 F2 was studied in the 90 - 200 K range. It was found that one of the reaction products is Cl F5. The final step of the hydrolysis is evidently more complicated and requires further study. The reaction of O2 F2 with Sn F4 forms O2 Sn F6. The reaction with WF6 and Mo F6 results in products with the approximate compositions O2 WF7. Author (TAB)

N70-17897 Mississippi Univ., University.
THE THEORETICAL ANALYSIS OF MIXED POTENTIALS AND ITS APPLICATION TO THE STUDY OF THE Fe(++)+ Ag(+) - Fe(+++)+ Ag REACTION
David Montgomery Gray (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-3961

A study has been made of the potential-time curves obtained in the investigation of the ferrous ion-silver ion reaction Fe(++) + Ag(+) equals Fe(+++) + Ag. The mechanism of this reaction and the role of ferric ion hydrolysis are discussed and equations are developed by which the progress of the reaction can be followed by noting the change in the hydrogen ion activity. This potential time behavior is unusual in that the potential initially drops rapidly and goes through a minimum and then rises to a fairly constant value. It is demonstrated that these potential time curves are the result of mixed potential generation in which the electrode characteristics, as well as the solution composition, are changing as a function of time. Since there exists no general mathematical treatment of mixed potentials involving more than two electrode processes, such a treatment is developed and applied to the reaction system in question. Dissert. Abstr.

N70-17898 Connecticut Univ., Storrs.
THE DIPHENYLIODONIUM ION IN LIGAND REACTIONS: A STUDY OF THE ARYLATION OF THIOOXALATO METALLATES
George Edward Hunter (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-2148

The arylation of bis(dithiooxalato)metallates using the diphenyliodonium ion as the arylating agent was studied under various conditions of solvent, temperature, and electromagnetic radiation. A unique feature of this study was that the starting materials were both contained in single pure compounds which were isolated: diphenyliodonium bis(dithiooxalato)platinate(II), palladate(II), and nickelate(II). Also prepared but not studied because of its instability was diphenyliodonium tris(dithiooxalato)chromate (III). An explanation of the aqueous insolubility of some diphenyliodonium salts is given in terms of Van der Waal's bonding between the soft acid iodonium ion and some soft base atom in the insoluble anion. A conductance study of electrolytes in dimethylformamide showed that different electrolyte types could be distinguished by the change in their molar conductance with concentration. There is no covalent bonding between diphenyliodonium ions and bis(dithooxalato)-metallate anions in dimethylformamide solution. Dissert. Abstr.

N70-17902 Massachusetts Univ., Amherst.
THEORETICAL KINETICS OF SIMPLE BIMOLECULAR REACTIONS
Lois Dalla Riva Gucwa (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-5444

The differential equation describing the reaction for the case of the linear collision was set up and solved. The electronic interactions were described by the Sato potential energy surface as modified by Weston, while the solutions to the nuclear motions were constructed from analytical functions limited to the asymptotic solutions in the regions of reactants and products. It was found that the analytical functions can give reasonably good solutions to the linear collision problem and that this type of function seems capable of serving as a basis for the construction of the solution to the general collision. Dissert. Abstr.

N70-17909# British Iron and Steel Research Association, London (England). Metallurgy Div.
THE DETERMINATION OF LEAD IN STEEL
[1969] 4 p *Its* BISRA Open Report Supersedes (MG/D/554/67) Avail: CFSTI

After initial dissolution of the steel, lead is extracted as its dithizone complex from an amminiacal citratecyanide solution into chloroform. The optical density of the lead dithizonate complex is determined photometrically and covers a lead content between 0.05 to 0.5 percent. From results obtained experimentally, a 95 percent confidence limit is established. Author

N70-17945 Alabama Univ., Universtiy.
THE HEATS OF FORMATION OF SELECTED CYANIDE AND OXALATE COMPOUNDS
Mary Ann Higgs Brown (Ph.D. Thesis) 1968 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-6530

The modification and operation of a glass Dewar type solution calorimeter with thermistors as the temperature sensing device is described. The major modification of the calorimeter was the addition of a recording potentiometer in conjunction with a direct current amplifier to record the off-balance signal from the temperature measuring bridge. The modified calorimeter was used to measure the heats of solution of the compounds needed to calculate the standard heats of formation of alpha oxalic acid, beta oxalic acid, sodium oxalate, potassium oxalate, potassium oxalate monohydrate, and cuprous cyanide. The standard heats of formation at 298.15 K are for alpha oxalic acid, -198.12 + or - 0.11 kcal/mol; for beta oxalic acid, -197.83 + or - 0.12 kcal/mol; for sodium oxalate, -315.41 + or - 0.10 kcal/mol; for potassium oxalate, -321.94 + or - 0.18 kcal/mol; for potassium oxalate monohydrate, -393.48 + or - 0.17 kcal/mol; and for cuprous cyanide, +23.80 + or - 0.27 kcal/mol. Dissert. Abstr.

N70-17948 Northwestern Univ., Evanston, Ill.
STUDIES OF ANION DIFFUSION IN LEAD SALTS
Yasutaka Ban (Ph.D. Thesis) 1968 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-6886

Several studies have been carried out concerning the diffusion of some elements in lead chalcogenides. In the present research the diffusion of selenium in lead selenide was predominantly studied with some incidential measurements. Single crystals of lead selenide were grown in a Bridgman furnace and they were equilibrated under a known partial pressure of selenium at various temperatures. Some crystals were doped with 1/2 mol% or 1/20 mol% of Ag2Se of Bi2Se3. Using radioactive selenium-75 diffusivities of selenium in these crystals were measured as a function of temperature and of the partial pressure of selenium. The diffusion anneals were carried out in the same conditions as the pre-diffusion anneals. The measurements of penetration curves of radiotracers were carried out by the residual activity method. Dissert. Abstr.

N70-17988# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ALUMINUM ANALYSIS BY MASS SPECTROMETRY K. FINDING A CORRELATION BETWEEN CERTAIN PHYSICAL PROPERTIES OF ELEMENTS AND THEIR RELATIVE SENSITIVITY COEFFICIENTS

M. Menetrier. Mar. 1969. 14 p. refs. Transl. into ENGLISH from Method. Phys. Anal. (Paris), v. 4, no. 2, Jun. 1968 p 153-160. Sponsored by MIT, Lincoln Lab.
(Rept-157-69-330-FRLL) Avail: CFSTI

A quantitative analysis of aluminum using a spark mass spectrometer required a knowledge of the relative sensitivity coefficients of all the elements. Standard references for all the elements must be prepared for an experimental determination of these coefficients. A theoretical calculation formula using coefficients of 21 elements was developed. Results of these calculations agree well with the experimental results. Author

N70-18000# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
NEW PHASES IN THE SYSTEM TITANIUM-OXYGEN
Ernst Hiltl. Apr. 1969. 3 p. refs. Transl. into ENGLISH from Naturwissenschaften (Berlin), v. 55, no. 3, 1968 p 130-131. Sponsored by MIT, Lincoln Lab.
(Rept-142-69-291-Gell) Avail: CFSTI

The system titanium-oxygen is radiographically studied in the range TiO sub 0 times 50 to TiO sub 1 times 50. Comparison of X-ray densities with measured densities for the exact composition TiO sub 1.00 shows that 1/6 of the oxygen and titanium positions are unoccupied when compared with a fully occupied NaCl structure. The following three structures are observed: (1) a cubic modification with NaCl structure and irregularly distributed gaps; (2) another cubic modification with gaps bound to certain point positions; and (3) a monoclinic modification in which all gaps are closed. Proven structures for the range TiO sub 1.00 to TiO sub 1.50 compromises: (1) an orthorhombic phase TiO sub 1.20, which appears under 820 degree C; and (2) a tetragonal phase TiO sub 1.25, which is stable under 720 degree C. G.G.

N70-18002# British Iron and Steel Research Association, London (England).
THE DETERMINATION OF BORON IN STEEL
[1969] 9 p. *Its* BISRA Open Report. Supersedes MG/DA/407/67 (MG/D/553/67) Avail: CFSTI

From a solution in dilute sulphuric acid, with hydrogen peroxide added, boron is separated by distillation as menthyl borate which is collected in dilute caustic soda solution. Following cautious evaporation to dryness, the boron-curcumin complex is developed in the presence of acetic and sulphuric acids and the liquid diluted to volume with an acetone-water solvent. The determination is completed photometrically. Author

N70-18004 Cincinnati Univ., Ohio.
LOW TEMPERATURE SPECIFIC HEATS OF SOLID NEON ISOTOPES
Eugene Cesar Somoza (Ph.D. Thesis) 1968 145 p. refs
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-6356

The specific heats of solid neon isotopes Ne-20 and Ne-22 have been measured in the temperature range 2.2 K to 24 K. In order to minimize the effects of systematic error, the isotopes were measured simultaneously in the same cryostat, which was equipped with a mechanical heat switch to provide the initial cooling of the samples. Temperatures were determined by means of matched germanium resistance thermometers, which were calibrated simultaneously against the vapor pressure of liquid helium at low temperatures and against a constant volume gas thermometer at higher temperatures. From the specific heat data several thermodynamic functions, such as enthalpy, entropy, Debye temperature, and the Gruneisen parameter, have been calculated as functions of temperature for the neon isotopes. Dissert. Abstr.

N70-18006 Houston Univ., Tex.
APPLICATION OF COMBINED GAS CHROMATOGRAPHY-MASS SPECTROMETRY TO THE ANALYSIS OF ORGANIC PRODUCTS OF BIOGEOCHEMICAL SIGNIFICANCE
Emilio Gelpi-Monteys (Ph.D. Thesis) 1968 741 p. refs
Avail: Univ. Microfilms: HC $33.35/Microfilm $9.40 Order No. 69-5366

Microorganisms contain significant amounts of aliphatic hydrocarbons and fatty acids. All of the microscopic algae analyzed contain high amounts of 17-C compounds and in two instances, high molecular weight olefins were found to be present in relatively high porportions. High amounts of isoprenoids (pristane and squalene) were found in shark livar oil. Relatively large amounts of isoprenoids were identified in a crude oil. Parafins, olefins, and methyl alkanes were identified in a concentrate of tobacco smoke. Terrestrial graphites contain n-alkanes, small amounts of methyl alkanes, and isoprenoids. A detailed study of a number of hydrocarbons observed in six carbonaceous chondrites resulted in the identification of nine homologous series of isomeric alkanes in addition to the n-alkane series. An identical study of the graphite-troilite nodules of three iron meteororites yielded results qualitatively very similar to the carbonaceous chondrites. Dissert. Abstr.

N70-18012# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ONSET OF SPONTANEOUS POLARIZATION IN LEAD STANNATE AND LEAD TANTALATE
G. A. Smolenskiy et al. May 1969. 4 p. refs. Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fiz. (USSR), v. 97, no. 2, 1954 p 237-238. Sponsored by MIT, Lincoln Lab.
(Rept-183-69-409-Rull) Avail: CFSTI

Temperature dependences of the dielectric constants and the tangency angle of the dielectric losses of partially crystallized lead stannate and lead tantalate samples of perovskite type are characteristic for crystals in which spontaneous polarization arises. It is shown that the dielectric constant of lead stannate does not exceed 20. G.G.

N70-18022 California Inst. of Tech., Pasadena.
EXCITONS IN CRYSTALLINE BENZENE
Steven Douglas Colson (Ph.D. Thesis) 1968 360 p
Avail: Univ. Microfilms: HC $16.20/Microfilm $4.60 Order No. 69-5685

The spectographs and excitation sources used to study the absorption and emission spectra of crystalline benzene are desoribed and their relative merits discussed. A new purification method is also described. This method, in which the benzene is vacuum refluxed over an approximately 100 C cesium mirror, can be used in conjunction with zone refining techniques to reduce the spectroscopic impurity level to 10 to the minus 6th power mole percent. The Frenkel theory for localized excitations in molecular crystals is redeveloped and extended for the case of benzene to lay a consistent theoretical framework for the interpretation of pure and mixed crystal spectra. The first and second triplets of solid benzene are observed using O2 and NO perturbation techniques. The absorption spectra of long benzene crystals of ultrahigh spectroscopic purity are discussed in terms of the unperturbed transition to the second triplet state. The phosphorescence spectrum of isotopic mixed benzene crystals is analyzed with special emphasis being placed on the effects of the static crystal field. The fluorescence and absorption spectra are used to supplement this analysis. Dissert. Abstr.

N70-18023 Arizona State Univ., Tempe.
INTERDIFFUSION STUDIES ON CUPROUS OXIDE AND FERROUS OXIDE
Ronald H. Campbell (Ph.D. Thesis) 1969 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-5710

The interdiffusion coefficients of oxygen and cuprous oxide and ferrous oxide were determined experimentally. At temperatures of 815 deg-1100 C, both thermogravimetric and conductivity measurements were made on cuprous oxide and thermogravimetric

measurements on ferrous oxide. The experimental results for both materials were compared to values of chemical diffusion coefficients calculated from the Darken equation. Agreement was good for the conductivity studies on cuprous oxide. Comparison of the experimental results for ferrous oxide with theory showed large deviations. It is thought that this deviation is caused by the large range of composition of ferrous oxide. It appeared that the correlation factor was no longer constant but was instead a function of the composition. Also the lattice parameter for FeO changes considerably with composition. A sudden change of the composition near the surface of the crystal will cause a stress gradient across the sample. To relieve this stress there will have to be a flux of matter normal to the concentration gradient. If the stress gradient is sufficiently large it is entirely possible that the rate of change of composition is controlled by the rate of relaxation of stress, i.e., by diffusion of iron in the absence of a concentration gradient. A modification of the Darken equation is proposed which takes into account the stresses present in an inhomogeneous material.
Dissert. Abstr.

N70-18024 Florida Univ., Gainesville.
DIELECTRIC PROPERTIES OF PURE ORGANIC LIQUIDS AND BINARY LIQUID SYSTEMS
Chun-Kiat Cua (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-5382

In a low intensity alternating field, the mechanical model proposed in this work results in an equation for dielectric constant identical in form with the Debye's dynamic equation. In a high intensity alternating field, the mechanical model predicts a high frequency saturation which is different from the low frequency or static saturation. This difference is due to the fact that the angular velocity of the rotating dipole is responsible for the high frequency saturation, whereas the orientation of the dipole is responsible for the static or low frequency saturation. Equilibrium constants may be calculated from the position of this maximum point.
Dissert. Abstr.

N70-18028 New Mexico Univ., Albuquerque.
DATA EVALUATION AND SHAPE DEPENDENCE IN THE PULSED NEUTRON TECHNIQUE
Kjell Walter Nielsen (Ph.D. Thesis) 1968
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-9261

Pulsed neutron measurements have been performed on H2O and polyethylene in cylindrical geometry. The main emphasis was on clearing up unexplained discrepancies as reported by others. The use of an extrapolated end point was avoided by using a Marshak boundary condition in the simple diffusion theory. Eigenvalues were calculated in terms of physical dimensions and diffusion coefficient. Percent radial leakage was used to describe systems as tall, symmetric and flat in an effort to determine whether or not a shape dependence exists within the limitations of simple diffusion theory.
Dissert. Abstr.

N70-18038# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFRARED ABSORPTION SPECTRA OF CYCLOTRIPHOSPHAZINE DERIVATIVES
G. G. Kotova et al 15 May 1969 16 p refs Transl. into ENGLISH from Neftekhim. (Moscow), v. 8, no. 2, 1968 p 289–296 (AD-696515; FTD-HT-23-59-69) Avail: CFSTI CSCL 7/4

IR spectra were determined for 22 derivatives of cyclotriphosphazine; the compounds had been previously synthesized and tested as thermal stabilizers in lubricating oil. The derivatives of the cyclic trimer of phosphonyl trichloride and the structural formula were substituted by total or partial replacement of chlorine. The IR spectra of cyclotriphosphazines can be used for defining the structure and for the detection of derivatives.
Author (TAB)

N70-18059 National Lending Library for Science and Technology, Boston Spa (England).
IMPREGNATION OF POROUS NICKEL PLATES IN CONCENTRATED CADMIUM - CHLORIDE SOLUTIONS
E. I. Gamaskin et al 21 Jul. 1969 11 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Russia), v. 42, no. 1, Jan. 1969 p 127–131 In RUSSIAN and ENGLISH
(NLL-Trans-746-180-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

The rate of impregnation of porous nickel plates in cadmium chloride solutions with a NO3 ion additive is determined by their surface condition. Removing the oxide film formed during sintering by pickling plates in a dilute nitric acid solution promotes dissolution of nickel and deposition of basic cadmium salts in the pores. The process takes place so rapidly that the surface pores become blocked by the deposit and the plates exhibit non-uniform impregnation over their depth. The passive oxide film may be removed during the actual impregnation by adding nitric acid to the solution. In such a case, due to the reduced rates of corrosion of nickel and cadmium hydroxide formation, at the beginning of the process the plates are impregnated more uniformly. The same effect is achieved by increasing the pore size of the plates from 20 to 30 to 30 to 50 microns.
Author

N70-18061 National Lending Library for Science and Technology, Boston Spa (England).
COMPLEXOMETRIC TITRATION (CHELATOMETRY). PART 7: PYROCATECHOL VIOLET, A NEW SPECIFIC INDICATOR. THE DETERMINATION OF NICKEL, COBALT, MANGANESE, ZINC, MAGNESIUM AND CADMIUM [KOMPLEXOMETRISCHE TITRATIONEN (CHELATOMETRIE) TEIL 7: BRENZCATECHINVIOLETT, EIN NEUER SPEZIFISCHER INDIKATOR. DIE BESTIMMUNG VON NICKEL, KOBALT, MANGAN, ZINK, MAGNESIUM UND CADMIUM]
M. Malat et al 21 Jul. 1969 10 p refs Transl. into ENGLISH from Collection Czech. Chem. Commun. (Prague), v. 19, 1954 p 1156–1161 In CZECHOSLOVAKIAN and ENGLISH
(NLL-Trans-746-182-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Complexometric determination of nickel, cobalt, manganese, zinc, magnesium, and cadmium is described, using pyrocatechol violet in buffered alkaline solutions. When Eriochrome Black T is used as an indicator, it is not possible to determine nickel and cobalt in a similar manner by a direct process, since this indicator forms irreversibly colored complexes with both nickel and cobalt. Zinc, magnesium, manganese, and cadmium were determined using Eriochrome Black. The titration of nickel and cobalt using pyrocatechol violet is a more suitable and reliable method for determination than titration with Murexide, in which the change in color may be appreciably influenced by the content of ammonium salts.
R.B.

N70-18075 Texas A&M Univ., College Station.
CRITICAL CONVERGENCE PRESSURE: A CRITERION FOR SELECTING EQUILIBRIUM RATIOS FOR COMPLEX HYDROCARBON SYSTEMS
Robert Christian Schlaudt (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-5151

Accurate predictions of physical properties for reservoir fluids are necessary for many calculations in petroleum engineering. These physical properties have been correlated as functions of fluid compositions. Under conditions which cause the reservoir fluid to separate into liquid and vapor phases at equilibrium, equilibrium ratios permit the calculation of the composition of each phase and the relative amount of each phase present. The magnitude of a particular equilibrium ratio is a function of pressure, temperature, composition of the mixture under investigation, and the volatility of the component. In this investigation, the critical convergence pressure has been defined. It is proposed as a more accurate method to account for the effects of mixture composition. This method resulted

in improving the per cent of usable solutions from 91.6% to 97.9% based on 191 available complex mixture systems. The improvement in average deviations for equilibrium ratios selected ranged from 0.8 to 11.5 per cent. Dissert. Abstr.

N70-18077 Virginia Univ., Charlottesville.
OXYGENATION OF COBALT (II) CHELATES
Michel S. Michailidis (Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-4003

The effect of molecular oxygen on solutions of cobalt(II) chelates with amino acids, amino acid amides, dipeptides, and simple amines is investigated by pH-Stat and absorption spectrophotometry. In the pH range 8–12, oxygenated intermediates are formed consisting of binuclear complexes with oxygen molecules acting as bridging groups. With ethylenediamine, histamine and glycinamide chelates dibridged species are formed presumably involving hydroxide groups as additional bridges, while the histidine, histidylglycine, histidinamide, glycylglycine and alpha,beta-diaminopropionic acid chelates give single-bridged binuclear complexes. Upon standing, the oxygenated complexes give cobalt(III) chelates at rates that are dependent on the effective charges on the metal ions and the ligand field strengths. The stoichiometry of the individual steps with regards to changes in [H+] is reported. Dissertation Abstract

N70-18078 Rensselaer Polytechnic Inst., Troy, N.Y.
THE PHOTOOXIDATION OF SOME AROMATIC AMINES
Edward A. Fitzgerald, Jr. (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-6459

The solution phase photochemistry of N,N'-dimethyl-N,N'-diphenylparaphenylenediamine, N,N,N',N'-tetraphenylparaphenylenediamine and para-hydroxydiphenylamine is studied. When these compounds absorb ultra-violet light in the wavelength range of approximately 2900A to 3600A, the excited state produced is deactivated by either fluorescence or oxidation, depending on the solvent. The products of the oxidation are the colored radical-cations of the amines which can also be produced by chemical oxidation with bromine. Irradiation of the amines in non-halogenated solvents such as ethanol or benzene yields fluorescence emission and no observed oxidation. Both fluorescence and oxidation occur simultaneously if a mixed solvent is irradiated. The quantum yields of fluorescence and photooxidation vary in a definite manner as the solvent ratio is varied. Dissert. Abstr.

N70-18092 Michigan State Univ., East Lansing.
SPECTROSCOPIC STUDIES OF ALKALI METAL SALT SOLVATION IN DIALKYLSULFOXIDES
Brian William Maxey (Ph.D. Thesis) 1968 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-5911

The techniques of far infrared spectroscopy and nuclear magnetic resonance spectrometry were combined to give a new and useful approach to the study of ionic solvation. Low frequency infrared bands were observed in solutions of alkali metal salts in dimethyl-, dipropyl- and dibutyl--sulfoxides which are attributable to the vibrations of cations in solvent cages. Isotopic substitution experiments demonstrated conclusively that both the cation and the solvent molecule were involved in the vibrating species. Studies of the S-O fundamental stretching mode indicated that the oxygen of the sulfoxide was oriented closest to the cation. The frequencies of the far infrared bands were highly dependent on the mass of the cation but showed no dependence on the mass of the anion. The intensities were directly proportional to the concentration of the salt employed. The results of nuclear magnetic resonance mole-ratio studies indicated a 1:2 stoichiometry; of the type M(DMSO)2(+) for both lithium ion and ammonium ion in dimethylsulfoxide solutions. Assuming a linear-tristomic model for the 1:2 solvates, it was possible to calculate force constants for the DMSO-cation bonds. Dissert. Abstr.

N70-18093 Pennsylvania Univ., Philadelphia.
THE ELECTRONIC SPECTRA OF BIPHENYL AND BIPHENYLENE
Robert Douglas McAlpine (Ph.D. Thesis) 1968 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-5642

The two lowest lying singlet-singlet electronic transitions of biphenyl and biphenylene were studied by absorption and emission techniques at 4.2 K. A theoretical model was proposed for the description of the vibronic states of benzene dimers in the vicinity of strong and intermediate coupling. The electronic wave functions, for the two lowest lying dimer singlet states, are formed from monomer benzene functions. The Herzberg–Teller terms from the monomer functions are found to be responsible for Herzberg–Teller Coupling in the dimer states. The intermediate coupling wave functions are formed by using the strong coupling functions as a basis set for a perturbation treatment. The strong coupling model was found to work very well for biphenylene. The vibrational frequencies in the two electronic states differ more than they do in biphenyl; this is probably because the coupling in biphenylene is stronger than in biphenyl. The two molecules studied give a clear indication that the strong coupling dimer model has experimental validity for certain composite molecules. Dissert. Abstr.

N70-18103 Oregon State Univ., Corvallis.
THE THERMODYNAMIC PROPERTIES OF MOLTEN MIXTURES OF SOME TRANSITION METAL HALIDES WITH SOME ALKALI HALIDES
Drannan Carson Hamby (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-5290

Thermodynamic properties including the activity coefficient, and the partial molar free energy, enthalpy, and entropy of mixing have been determined for the solutes $NiCl_2$ and $CoCl_2$ in the solvents KCl, NaCl, LiCl and 1:1 NaCl-KCl. The values of the properties were established by measuring the reversible emf's of cells of the type: M | MCl_2, RCl | Cl_2, C, where R represents an alkali metal cation. Cell emf's were determined over a range of concentration from approximately 0.0004 to 0.5 mole fraction of solute and temperatures ranging from the melting points of the solvents to 900 C. The experimentally determined entropy of mixing has been compared with calculated values based on several microstate models. The relationship between cell emf and temperature was found to be in agreement with that established by Senderoff and Mellors. Dissert. Abstr.

N70-18104# National Bureau of Standards, Washington, D.C.
BOND DISSOCIATION ENERGIES IN SIMPLE MOLECULES
B. deB. Darwent (Catholic Univ. of America) Jan. 1970 64 p refs
(NSRDS-NBS-31) Avail: SOD $0.55

Bond dissociation energy values (kcal/mol) and (kJ/mol) of simple compounds are tabulated from a literature review covering the years 1962 to 1966 inclusively. Some selected values which appeared in the years 1956 to 1962 are also included. Organic compounds are excluded except those containing one carbon atom. The values are quoted usually at 0 K or 298 K and refer to the gaseous state. They represent the energy required to break a bond at the specified temperature with all substances in the zero vibrational state of the ground electronic state. The experimental method for the energy value listed is given and referenced in the table. A recommended value is listed as the final value for each reaction. Author

N70-18117 Pennsylvania State Univ., University Park.
PHASE EQUILIBRIA IN A PORTION OF THE SYSTEM Fe-C-O FROM 250 TO 10,000 BARS AND 400 C TO 1200 C AND ITS PETROLOGIC SIGNIFICANCE
Jerry Raymond Weidner (Ph.D. Thesis) 1968 171 p

Avail: Univ. Microfilms. HC $8.00/Microfilm $3.00 Order No. 69-5593

The phase equilibria in a portion of the system Fe-C-O were determined at elevated temperatures and pressures in order to define the boundary conditions, terms of temperature and pressure, for the natural occurrence of siderite and the assemblage siderite plus hematite and to provide information about the melting behavior of the iron oxide minerals in the presence of a vapor phase under pressure. The univariant reactions, hematite + siderite = magnetite + vapor and siderite = magnetite + graphite + vapor, were studied in the pressure range 500 to 10,000 bars and the temperature range 300 C. to 800 C. by the quenching technique using sealed gold capsules and cold-seal pressure vessels. Synthetic siderite and mixtures of synthetic siderite plus hematite were used as starting materials. Dissert. Abstr.

N70-18120# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KINETICS OF THE THERMAL-RADIATION DECOMPOSITION OF NO2 IN A FLUX
G. V. Nichipor 23 Sep. 1969 8 p refs Transl. into ENGLISH from Akad. Navuk BSSR, Minsk. Vests i Seryya Fiz.-Tekhn. Navuk, (Russian), no. 4, 1967 p 29 - 34
(AD-696330; FTD-HT-23-259-69) Avail: CFSTI CSCL 7/5

A mathematical description is given the kinetics of the radiation-thermal decomposition of nitrogen dioxide in one-dimensional flow with use of the known equations of energy and mass transfer. The reaction mechanism was examined. The ratio of the rates of the initial radiation and thermal decompositions of NO2 was evaluated. Under conditions of high temperature flow, effects caused by the effect of thermal decomposition NO2 on the radiation decomposition were additive. In this case the process is described by a system of 8 differential equations of the first order with nonlinear right-hand terms. Author (TAB)

N70-18125 West Virginia Univ., Morgantown.
SPECTRAL AND MAGNETIC STUDIES OF COMPLEXES OF COPPER(II) WITH VARIOUS ALKANOLAMINES
Donald Gates Brannon (Ph.D. Thesis) 1968 210 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-6706

Numerous complex compounds of cooper (II) with various alkanolamines were synthesized and their electronic reflectance spectra at ambient and liquid nitrogen temperatures, infrared spectra, magnetic moments, and X-ray trace spectra were determined. Structures involving planar, trigonal bipyramidal and distorted octahedral configurations are proposed for the various compounds. The electronic reflectance spectra were resolved into their respective Gaussian components and appropriate values were calculated. Dissert. Abstr.

N70-18128# ARO Inc., Arnold Air Force Station, Tenn.
PRELIMINARY INVESTIGATION OF THE INTERACTION OF 0.30-eV TO 0.54-eV GASEOUS ARGON WITH A SOLID ARGON SURFACE Final Report, Oct. - Nov. 1968
M. R. Busby and R. F. Brown Arnold Eng. Develop. Center Nov. 1969 48 p refs
(Contract F40600-69-C-001)
(AD-696106; AEDC-TR-69-195) Avail: CFSTI CSCL 7/4

An aerodynamic molecular beam and phase-sensitive detection system were used to investigate the spatial distributions of argon atoms reflected from solid argon for incident energies of from 0.30 (beam temperature of 1400K) to 0.54 eV (beam temperature of 2500K), incident angles from 0 to 70 deg, and solid argon temperatures of 15K. Both in-plane and out-of-plane spatial distribution measurements were made, and highly nondiffuse supraspecular spatial flux distributions were observed for the noncondensing atoms. The angle of maximum reflected intensity was independent of both beam incident angle and beam energy. For incident angles (measured with respect to the surface normal) of 5 deg or less, backward reflection lobes were observed, and the magnitude of the reflected flux increased as the angle of incidence approached zero. The beam capture coefficient was a function of the incident beam energy and the angle of incidence. However, with a beam source temperature of 2500K, the capture coefficient was near unity for normal incidence. Author (TAB)

N70-18132 California Inst. of Tech., Pasadena.
THE 3.7 A CRYSTAL STRUCTURE OF HORSE HEART FERRICYTOCHROME C. PART 1. THE APPLICATION OF THE KARLE-HAUPTMAN TANGENT FORMULA TO PROTEIN PHASING, PART 2
Jon Edward Weinzierl (Ph.D. Thesis) 1969 334 p
Avail: Univ. Microfilms: HC $15.10/Microfilm $4.30 Order No. 69-5692

I. The crystal structure of horse heart ferricytochrome c has been determined to a resolution of 3.7 A using the multiple isomorphous replacement technique. Two isomorphous derivatives were used in the analysis, leading to a map with mean figure of merit of 0.458. The quality of the resulting map was extremely high, even though the derivative data did not appear to be of high quality. Although it was impossible to fit the known amino acid sequence to the calculated structure in an unambiguous way, many important features of the molecule could still be determined from the 3.7 A electron density map. II. The Karle-Hauptman tangent formula has been shown to be applicable to the refinement of previously determined protein phases. Tests were made with both the cytochrome c data from Part I and a theoretical structure based on the myoglobin molecule. The refinement process was found to be highly dependent upon the manner in which the tangent formula was applied. Iterative procedures did not work well, at least at low resolution. Dissert. Abstr.

N70-18138 Brigham Young Univ., Provo, Utah.
HIGH PRESSURE, HIGH TEMPERATURE SYNTHESIS OF SELECTED RARE EARTH POLYSULFIDES AND POLYSELENIDES
Alan Wendall Webb (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-5782

The rare earth polysulfides and polyselenides of Tm, Yb, and Lu are unknown. The ionic radius of the rare earth has become too small to allow the structure common to the known members of the series, and with the polysulfides the stable temperature zone is too low to give the high sulfur pressure necessary for synthesis of RS2. It was felt that high pressure, high temperature techniques could be used to overcome both problems and to allow synthesis of compounds not possible by ordinary methods. Synthesis studies were carried out on mixtures of the rare earth element plus sulfur in the 1:2 mole ratio for Nd, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y. The known polysulfide series was extended three members. TmS2, YbS2, and LuS2. A high pressure pseudo-cubic polymorph was found for nine members, GdS2, TbS2, DyS2, HoS2, ErS2, TmS2, YbS2, LuS2, and YS2. Dissert. Abstr.

N70-18148 Alabama Univ., University.
RATE MECHANISM FOR ADSORPTION ON MOLECULAR SIEVES
Rudy Elvis Rogers (Ph.D. Thesis) 1968 174 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-6566

The rate mechanism of adsorption was studied in a helium-Freon-molecular sieve system by a frequency response technique in which the Freon adsorbate of the binary gas mixture was varied sinusoidally about a 1.5% mean concentration; diffusivities, adsorption equilibrium coefficients, and the energy of adsorption were determined. The study was undertaken to provide additional insight into adsorption rate processes and to provide basic rate

mechanism information for the rapidly increasing uses of industrial adsorption processes which have been greatly enhanced by the recent advent of molecular sieves. Dissert. Abstr.

N70-18151# Army Foreign Science and Technology Center, Washington, D.C.
INVESTIGATIONS IN THE FIELD OF ALKOXY SILANES
R. M. G. Voronkov et al 21 Oct. 1969 12 p refs Transl. into ENGLISH from Khim. Geterotsikl. Soedin., Akad. Nauk Latv. SSR (Riga), no. 6, 1968 p 972–975
(AD-696455; FSTC-HT-23-719-69) Avail: CFSTI CSCL 7/3

Spirocyclic glycol esters of orthosilicic acid were obtained by catalytic disproportionation of the corresponding polyester, obtained by ester interchange of tetraethosysilane with glycols. Their proton magnetic resonance spectra were investigated and their dipolar moments were measured. Author (TAB)

N70-18156 Texas Christian Univ., Fort Worth.
X-RAY CRYSTAL STRUCTURE STUDIES OF METAL COMPLEXES
Rickey Jay Williams (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-6610

The X-ray crystal structure studies using the multiple film equi-inclination Weissenberg technique was completed on three classes of metal complexes. These include: (1) Copper(II) chloride complexes of substituted pyridine N-oxides, including the crystal and molecular structures of di-mu-(pyridine oxide)-bis(dichlorocopper(II)) and trans-dichlorodiaquobis(4-nitropyridine N-oxide) copper(II). (2) Complexes containing dimethyl sulfoxide including the crystal and molecular structure of trans-dichlorobis (dimethyl sulfoxide) palladium(II). (3) Eight coordinated rare earth complexes including the crystal and molecular structure of tris(acetylacetonato) (phenanthroline)europium(III). Dissert. Abstr.

N70-18166# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
MEAN SQUARE SHIFT FOR SUBLATTICES OF THE COMPOUNDS Cd Te, Hg Te, AND THE SOLID SOLUTION (Hg Cd) Te (20 MOL. PERCENT CdTe) [SERDENEKVADRATICHNYYE SMESHCHENIYA DLYA PODRESHETOK SOYEDINENIY CDTE, HGTE I TVERDOGO RASTVORA (HGCD)TE (20 PERCENT MOL CDTE)]
V. T. Bublik et al 1968 7 p refs Transl. into ENGLISH from Izv. VUZ Fiz. (USSR), no. 11, 1968 p 142–145 Prepared for MIT
(AZT-69-485-RULL) Avail: CFSTI

The mean square shift was determined by a measurement of the temperature dependence of the integral intensity of X-ray reflections. Single crystals cut along the (100) plane were used. The energy of formation of a vacancy in the HgCd sublattice of (HgCd)Te alloy was found to be close to the amount of energy required for forming a vacancy in the Cd lattice of CdTe. Graphs showing the temperature dependence are given. N.E.N.

N70-18196# Joint Publications Research Service, Washington, D.C.
DEVELOPMENT OF CHEMICAL RESEARCH ON ARTIFICIAL AND SYNTHETIC FOOD
V. M. Belikov et al 6 Jan. 1970 43 p refs Transl. into ENGLISH from Usp. Khim. (Moscow), v. 38, no. 9, 1969 p 1589–1596
(JPRS-49554) Avail: CFSTI

Production of synthetic food by industrial methods is reviewed, including the high cost of amino acids, fatty acids, and vitamin reagents. Yeast biomass containing 40 percent protein is briefly mentioned. Derivation and production of protein and amino acids for meeting man's nutritional requirements are discussed, along with odor and taste development to make the food appetizing. Work on external attractive appearance (color and form) in the artificial food has begun. J.A.M.

N70-18225 Northwestern Univ., Evanston, Ill.
THE DIFFUSION OF NICKEL AND CHLORINE INTO LEAD TELLURIDE
Thomas Dale George (Ph.D. Thesis) 1968 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-6927

The diffusion of nickel in lead telluride, the interaction of nickel with the lattice, and the simultaneous diffusion of nickel and chlorine have been investigated as a function of crystal composition and ambient conditions above the crystal at 700 C. Under inert or reducing atmospheres the diffusion of nickel is very rapid while under oxidizing conditions diffusion is much slower. The diffusion coefficient for nickel under a tellurium atmosphere into a crystal containing excess tellurium is given. It is believed that a different nickel species migrates under oxidizing and reducing conditions. In addition it has been shown that annealing a nickel-doped crystal in a tellurium atmosphere causes nickel to migrate out of the crystal. Dissert. Abstr.

N70-18249# British Iron and Steel Research Association, London (England). Metallurgy Div.
NITROGEN DETERMINATION IN STEEL USING AUTOMATIC TITRATION
G. D. Hall and P. H. Scholes [1969] 10 p refs *Its* BISRA Open Report Supersedes MG/D/343/66 (MG/D/460/67) Avail: CFSTI

The feasibility of nitrogen determination by titrating the ammonia distillate using an automatic titrimeter was examined. Tests on a series of standard steels indicate: (1) an increase in operational speed as compared to the conventional procedure; (2) the automated procedure is markedly superior to manual operation for analysis of low-nitrogen steels; (3) with the exception of high-nitrogen valve steel, the standard deviation lies between plus or minus 0.0003 and 0.0006 percent; and (4) while blank values are relatively high, this is compensated for by the rapidity and ease with which large numbers of samples can be handled. Testing procedures are described and results are tabulated. D.L.G.

N70-18253# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
MASS-SPECTRAL METHODS OF ANALYZING HIGH-PURITY MATERIALS
M. S. Chupakhin Apr. 1969 12 p refs Transl. into ENGLISH from Izv. AN SSSR, Neorganicheskiye Materialy, (USSR), v. 4, no. 11, 1968 p 2010–2015 Prepared for MIT
(Rept-(162)-69-372-RULL) Avail: CFSTI

The analytical potential of spark mass-spectrometry for determination of impurities in solids of high purity and in liquids was investigated. Emphasis was placed on establishing values of sensitivity by use of the method with various materials. The effects of variation in procedure are discussed and limitations of the method are specified. D.L.G.

N70-18285# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PHYSICO-CHEMICAL STUDY OF THE SYSTEM PbTe-GeTe
S. G. Karbanov et al May 1969 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (RUSSIAN), v. 5, no. 2, 1969 p 270–274 Sponsored by MIT, Lincoln Lab.
(Rept-169-69-390-RULL) Avail: CFSTI

The phase diagram of a lead and germanium telluride system is refined and the vapor pressure in the range of solid solutions is measured by the Knudsen method. Qualitative mass spectroscopic studies show that the vapor consists mainly of PbTe and GeTe molecules. A limited solubility in the solid state is observed in the system. R.B.

N70-18288 Pennsylvania State Univ., University Park.
A KINETIC STUDY OF SOME THIRD ORDER REACTIONS INVOLVING NITRIC OXIDE

Leo Zafonte Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-5596

The third order reactions 2NO + X2 = 2NOX (X = O, Cl, Br) were investigated with a rapid scanning spectrometer. The reactions which had half lives from one second to one hour were followed by observing the optical density change of the product NOX band in the infrared region. It was found for the reaction of nitric oxide with X2 that the third order rate law is strictly followed under both pseudo first order and pseudo second order conditions.
Dissert. Abstr.

N70-18297 Pennsylvania State Univ., University Park.
PHASE RELATIONS IN THE SYSTEM LI2O-NA2O-AL2O3-SiO2 WITH SPECIAL EMPHASIS ON THE SILICA POLYMORPHS
William Barton Badger (Ph.D. Thesis) 1968 311 p
Avail: Univ. Microfilms: HC $14.20/Microfilm $4.00 Order No. 69-5529

Phase relationships in the high silica region of the quaternary system were studied by "Quenching," isothermal transformation techniques, high temperature X-ray diffraction, and the polarizing microscope. Liquidus and subsolidus equilibrium relationships were determined for four sections in the quaternary system, involving the phases eucryptite, spodumene, nepheline and albite. Refractive indices of glasses, primary phases and liquidus data were obtained for compositions on the 50, 60, 70, 80, and 90 weight per cent silica planes in the quaternary system. Compatibility tetrahedra and the probable relationship between the various types of quaternary invariant points were illustrated. Axial thermal expansion data were obtained for several of the quartz-type phases and these data and the equilibrium and non-equilibrium data were related to the geochemical and ceramic problems involving the quartz phase or its solid solutions.
Dissert. Abstr.

N70-18298# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
RADIOGRAPHIC STUDY OF THE TITANIUM MONOXIDE-LOW TEMPERATURE-MODIFICATION
E. Hilti and F. Laves Apr. 1969 4 p refs Transl. into ENGLISH from Naturwissenschaften, (Germany), v. 55, no. 3, 1968 p 131
Prepared for MIT
(Rept-(143)-69-292-GELL) Avail: CFSTI

A crystal complex rod which behaves radiographically like a dodecagonal crystal constructed from three tetragonal crystals is described. The rod is obtained from tempered monocrystal of a TiO modification at 980 C. A pseudocubic-monocubic cell similar to a NaCl-type cell is used as a model. Tetragonal crystal share measurements are illustrated and their interrelationships are discussed.
D.L.G.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-18962# Advisory Group for Aerospace Research and Development, Paris (France).
AEROMEDICAL ASPECTS OF RADIO COMMUNICATION AND FLIGHT SAFETY
Dec. 1969 160 p refs Held at Brooks, AFB, Tex., 13–14 May 1969
(AGARD-AR-19) Avail: CFSTI

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13. VOCAL INDICATIONS OF EMOTIONAL STRESS IN AIRCRAFT PILOTS AS PERCEIVED BY AIR TRAFFIC CONTROLLERS S. E. Stuntz (Stanford Res. inst., Menlo Park, Calif.) 6 p refs (See N70-16975 06-07)

N70-18964# Decca Navigator Co., Ltd., London (England). Digital Communications Lab.
THE INTERACTION OF COMMUNICATION WITH COCKPIT WORKLOAD AND SAFETY
H. P. Ruffell Smith and B. D. Parker *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 10 p refs (See N70-18962 06-07)
Avail: CFSTI

Intercommunication between ground control and aircraft in areas of high density traffic requires radio telephone exchange as well as a fast data link to prevent error judgments by the pilot. The data link enables the aircrafts navigation computer to talk to the ground control computer once the aircraft is inside radar cover and thus supports the radio telephone exchange from cockpit to ground. Broadcast data from the ground to all aircraft may be any combination of numeric, plain or symbolic language and can be divided into three categories, machine to machine, "shorthand" and plain language. Digital communication links reduce pilot workload and increase aircraft safety.
G.G.

N70-18965# Army Aeromedical Research Unit, Fort Rucker, Ala.
PHILOSOPHIES OF VOICE COMMUNICATION SYSTEMS DESIGN

Robert T. Camp, Jr. *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 4 p (See N70-16962 06-07)
Avail: CFSTI

There is a need for improved aircraft voice communication systems in the armed services, FAA and NASA applications. Recorded samples show the urgent need for improvement. It is proposed that the philosophy of systems design that has evolved since World War II is largely responsible for the present low efficient systems. The popular assumptions held by design engineers about distortion, bandwidth conservation and intelligibility criteria explain some of the impedances to the successful development of ideal systems. As a solution to the problem, a new philosophy of communication systems design is proposed. Data from recent experiments support the argument that the realization of improved voice communication systems will depend largely upon a change of philosophy. Tape recordings of new experimental systems are presented as evidence that it is possible to have high intelligibility under high ambient noise conditions. A basis for changing criteria for accepted speech intelligibility is presented. Author

N70-16966# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.
SPEECH INTELLIGIBILITY IN NOISY ENVIRONMENTS
J. C. Webster *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 16 p refs (See N70-16962 06-07)
Avail: CFSTI

Studies have suggested simplified procedures for estimating the speech interfering aspects of noises and have resulted in new specifications of allowable noise levels in ship compartments or air control towers. Developments have resulted in the mobile transceiver system used on the flight deck of aircraft carriers. Ongoing work on man-on-the-move communications (MOMCOM) will update the present flight deck radio and expand its usage to other fleet needs. These studies and their application to communication equipment development and design will be discussed. Author

N70-16968# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
SPEECH INTELLIGIBILITY IMPROVEMENT VIA SELECTIVE LOUDSPEAKER PLACEMENT
Jerry V. Tobias *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 10 p refs (See N70-16962 06-07)
Avail: CFSTI

Most pilots of light aircraft seem to prefer loudspeakers to earphones. This usage leaves the ears uncovered, which is sometimes considered to be a social advantage if the pilot wants to converse with other occupants of the plane, but has two notable disadvantages: it increases the pilot's exposure to fatiguing noise, and it vastly decreases the signal-to-noise ratio for incoming messages. The auditory-fatigue problem can be handled by pilot education; the problem of deteriorating signal-to-noise ratio, though, can be approached not just by putting earphones on flyers, but also by applying to the loudspeaker situation some of the theoretical principles that have led to techniques of apparent signal-level and speech-intelligibility improvement under earphones. These techniques have now been tested in loudspeaker listening situations and have proven to be equivalent to a 5 dB rise in signal-to-noise ratio. The method is based in the human observer's signal-processing ability, and thus requires no special equipment in the aircraft. Two loudspeakers are required, and they are driven from the same signal source, with the two speakers wired in opposite phase of each other. Within limits, a broad variation in speaker placement will permit similar improved results. These limits are defined. Author

N70-16969# Naval Aviation Safety Center, Norfolk, Va. Naval Safety Center.
RADIO COMMUNICATIONS PROBLEMS AND AVIATION ACCIDENTS IN THE US NAVY
Robert A. Alkov *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 4 p (See N70-16962 06-07)
Avail: CFSTI

It can be seen that the majority of these accidents where a breakdown in communications occurred involved individuals who spoke the same language but failed to convey meaning in an adequate fashion. This may be traced in part to phonetic similarities in certain key words or misinterpretation of meaning when language use was not possible and visual signals were used. In other instances, communications discipline would suffice to prevent problems from occurring. As for the problem of noisy flight decks, a systems analysis of the information gathering, processing and disseminating network needs to be made on aircraft carriers. Author

N70-16971# Bell Telephone Labs., Inc., Murray Hill, N.J.
THE INTELLIGIBILITY OF SHOUTED SPEECH
Donald J. Mac Lean and A. Michael Noll *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 15 p refs (See N70-16962 06-07)
Avail: CFSTI

The results of carefully-controlled laboratory experiments using modified-rhyme intelligibility tests indicate that extremely-shouted speech is less intelligible than normal speech. But while infinite peak clipping degrades the intelligibility of normal speech, the same infinite peak clipping of shouted speech makes it almost as intelligible as normal speech. Large amounts of additive white noise after the peak clipping severely degrade the intelligibility of both the shouted and normal speech almost equally. With shouted speech it is more difficult to identify the speaker. One tempting conclusion to be made from the results of these experiments is that peak clipping of severely shouted speech in a relatively noise-free environment actually is desirable since the clipping improves the intelligibility of the received message. However, during many emergencies the environment is extremely noisy, and peak-clipping of noisy shouted speech might not improve its intelligibility. Author

N70-16972# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
A DISCUSSION OF COLOR SIGNALS AND THEIR FLIGHT SAFETY RELATIONSHIP TO RADIO COMMUNICATIONS IN CIVIL AVIATION
Harry L. Gibbons and Mark F. Lewis *In* AGARD Aeromed. Aspects of Radio Commun. and Flight Safety Dec. 1969 5 p refs (See N70-16962 06-07)
Avail: CFSTI

The saturation of the air traffic control system has evoked many suggested solutions of the problem. Some would remove man-to-man communication by an automated system of color signals. Color coding for various aspects of approach or ground control is planned or being implemented. At a recent flight safety meeting, three of six planned improvements in approach, landing, and ground navigation involved color signals. A previous study indicates that color signals which are complex, or not frequently utilized, are not commensurate with flight safety. Other data indicate that 4.5 per cent of military pilots have color vision deficiencies of the type that could experience difficulty utilizing new color systems. Effective screening of persons with the less severe color vision deficiencies has never been successful due to test deficiencies, personnel limitations, and motivation to pass tests. The replacement of voice communication by color signals is not recommended. Author

N70-16975# Stanford Research Inst., Menlo Park, Calif.
VOCAL INDICATIONS OF EMOTIONAL STRESS IN AIRCRAFT PILOTS AS PERCEIVED BY AIR TRAFFIC CONTROLLERS
Stephen E. Stuntz *In* AGARD Aeromed. Aspects of Radio

Commun. and Flight Safety Dec. 1969 6 p refs (See N70-16962 06-07)
Avail: CFSTI

Air traffic controllers frequently utilize what they perceive to be emotional-state cues in the speech of pilots during air-ground voice communication, in judging the needs of a pilot for traffic-control assistance. When confronted with evidence of apparent emotional stress in a pilot, controllers often modify their speaking-behavior so as to counteract the condition, rendering the pilot more amenable to assistance and reducing flight safety hazards. At present the process is highly intuitive, and no specific doctrine or guidelines are available to assist the controller in interpreting pilots' speech mannerisms. There is a considerable body of anecdotal evidence that controllers do in fact develop skill in judging pilots' emotional state from vocal indications, and that controllers' vocal countermeasures may have higher than chance effectiveness. This report describes a preliminary study of air traffic controllers' practices, and suggests an approach to the problem of assessing talkers' emotional state by listener judgment, within the framework of air-ground voice radio communiation. Author

N70-17039# Texas Univ., Austin. Electronics Research Center.
A UNIFIED PERFORMANCE ANALYSIS OF ADAPTIVE AND SELF-SYNCHRONIZING RECEIVING SYSTEMS
Claude H. Feistel and William D. Gregg 24 Mar. 1969 69 p refs
(Grant AF-AFOSR-766-67)
(AD-696639; TR-62; AFOSR-69-1027TR) Avail: CFSTI CSCL 17/2.1

Various results have been achieved in unifying the analysis and interpretation of coherent and noncoherent digital data communication systems, by both theoreticians and systems engineers. This research has been concerned with an analysis, unification, and interpretation of the more significant aspects of partially coherent, adaptive, and self-synchronizing digital data receiving system concepts, under a common physical parameter framework. The partially coherent system concepts considered, consist of: (1) The Squaring-Tracking concept, (2) The Pilot-Tone or Residual Carrier concept (employing a first order loop), (3) The Differential Phase Shift Keying (DPSK) concept. Performance characteristics (error probability) for the partially coherent receiver concepts are obtained under a common and unified receiving systems framework. It is assumed that the channel phase modulation effects are tracked in a quasi-steady state mode by the reference acquisition loops, that is with a small value of dynamic phase lag. The partially coherent receivers are assumed to employ realizable filter forms. System performance is illustrated graphically along with interpretive comments and compared with ideal reception (coherent PSK). Author (TAB)

N70-17047*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF SPACECRAFT INTERFERENCE ON A 136 MHz PCM TELEMETRY DATA LINK
Ralph E. Taylor and Thomas J. Karras Nov. 1969 55 p refs Submitted for publication
(NASA-TM-X-63794; X-523-69-506) Avail: CFSTI CSCL 09F

The results of a radio-frequency interference analysis of fourteen station-recorded magnetic tapes, found in a randomly selected seven-day interval for the Orbiting Solar Observatory OSO-5(F) spacecraft are described. These data tapes were examined to determine the amount of radio-frequency interference present, injected by other spacecraft operating within the same frequency band, that was recorded along with the OSO-5(F) 136 MHz pulse-code modulated telemetry data signal. It is shown that the spacecraft radio-frequency interference prediction, the data processing tape analysis results, and the STADAN station interference reports correlate well. The analog data tape analysis reveals about the same order of magnitude of spacecraft type interference compared to the station reports. Author

N70-17052# General Electric Co., Schenectady, N.Y. Research and Development Center.
THE ADAPTIVE DETECTION AND ESTIMATION OF NEARLY PERIODIC SIGNALS
Thomas G. Kincaid Jul. 1969 32 p refs
(Contract Nonr-4692(00))
(AD-697003; S-69-11239) Avail: CFSTI CSCL 9/4

The report proposes a design of an adaptive receiver for the detection and estimation of nearly periodic signals in additive Gaussian noise. A nearly periodic signal is defined to be a sample function of a Gaussian random process which can be divided into equal length intervals, called periods, in such a manner that the correlation between periods decreases exponentially with their separation. The receiver computes a low signal-to-noise ratio conditional likelihood ratio from which the observer must make decisions. The likelihood ratio is conditional because the receiver estimates any unknown parameters necessary for the computation of the true likelihood ratio. Thus the receiver can only compute a likelihood ratio conditioned upon these estimates being the true values of the unknown parameters. The receiver consists of pre-emphasis filters followed by a comb filter, energy detector, and weighted summation. A theoretical evaluation of the receiver, in terms of ROC curves, is made for the special case of nearly periodic signals with statistically independent equal-strength harmonics in white noise of known power. Author (TAB)

N70-17094# Applied Physics Lab., Johns Hopkins Univ., Silver Springs, Md.
THE SMALL ASTRONOMY SATELLITE COMMAND DATA ENCODER
A. J. Pokorny Mar. 1969 58 p refs
(Contract NOW-62-0604)
(AD-696160; APL-TG-1065) Avail: CFSTI CSCL 17/2.1

The Small Astronomy Satellite contains a PCM command system to provide housekeeping and experiment control. To exercise this system, ground hardware was developed that encodes a partitioned computer word, or a manually inserted sequence, into the standard NASA PCM command data system format. The format used for the SAS spacecraft is a 64 bit FSK-AM signal containing leading and trailing synchronization, satellite address, intersystem decoding information, and command. Design, system operation, construction and adjustment of the ground encoder are discussed using block diagrams, timing charts, waveforms, and photographs. Author (TAB)

N70-17149# Florida Univ., Gainesville. Communication Sciences Lab.
A METHOD FOR ANALYZING PHONEMIC ERRORS IN UNDERWATER SPEECH INTELLIGIBILITY TESTING
Harry Hollien, John F. Brandt, and Thomas Murry 1 Sep. 1969 15 p refs
(Contract Nonr-580(20))
(AD-696123; CSL/ONR-24) Avail: CFSTI CSCL 17/2

A method for analyzing listeners phonemic confusions of monosyllabic words was developed in order to determine the type as well as the number of consonant errors made in divers speech. This method, which deals exclusively with consonants, allows for the listeners responses to be written in phonetics or traditional orthography. Therefore, it can be used with experienced or naive listeners which, in large scale intelligibility testing, is desired or necessary. From the listeners responses, the errors are grouped into simple consonant-for-consonant substitutions, substitutions involving consonant clusters, and omissions, and additions. The results of the analyses are presented in terms of the percent correct for each phoneme relative to the total possible number of correct phonemes at a certain condition. In this way, the relative intelligibility of each phoneme may be obtained and compared with other phonemes in the same test or with the same phoneme in various testing situations. Preliminary data indicate that the reliability of transforming the orthographic responses to phonemes ranges from 86.7 to 93 percent. Some results of the initial application of this procedure

to the phonemic confusions of divers speech in Helium-oxygen environments indicate that majority of confusion occurs among sounds produced with the same voicing component within the same manner and place of articulation categories. With regard to the errors of place of articulation, the confusions were approximately random. Author (TAB)

N70-17172# Signals Research and Development Establishment, Christchurch (England).
THE RATING OF DELTA SIGMA MODULATING SYSTEMS, WITH CONSTANT ERRORS, BURST ERRORS AND TANDEM LINKS IN A FREE CONVERSATION TEST USING THE REFERENCE SPEECH LINK
L. S. Butler and Lesley Kiddle Feb. 1969 32 p refs
(AD-696931; SRDE-69014) Avail: CFSTI CSCL 17/2

The report describes a free conversation opinion test, designed on a statistical basis, to assess the performance of Delta Sigma equipments, connected both singly and in tandem. Tests were made at digit rates of 19/2 kb/s and 12 kb/s. The single links were tested with errors introduced into the digit stream, the errors being either randomly distributed at a constant density of 10% or in bursts. In all cases the Delta Sigma equipments were rated higher on the sensitivity/noise scale than the Army Standard. Author (TAB)

N70-17195# Selenia S. P. A., Rome (Italy).
PAS LINK EVALUATIONS DURING TRANSFER ORBIT
M. Tuccari, A. Teofilatto, and G. Wiegman 1 Aug. 1967 69 p Sponsored by ELDO
(Rept-TR-67/520) Avail: CFSTI

This report concerns calculations of the tracking, telemetry and command links for Gove, Redu and Port Stanley stations, during six transfer orbits of the PAS injection system. The first part gives the satellite coordinate calculations for the three stations corresponding to the six orbits, and calculations of the angle between the satellite spin axis and the line of sight. This angle was used to determine the minimum onboard antenna gain for different directions. For the ground stations, the existing ELDO data were taken. In every link a six decibel margin was taken as required by ELDO. The proposed onboard antenna solutions are considered; results are tabulated for several points along each orbit. It is shown that it will always be possible to have radio links except for a few brief intervals when the angle of elevation is less than 10 deg. Author (ESRO)

N70-17242# Stromberg Datagraphics, Inc., San Diego, Calif.
STUDY AND INVESTIGATION OF DIELECTRIC MEMBRANE LIGHT VALVE TECHNIQUE Final Technical Report
Edmund Rottmiller Oct. 1969 140 p refs
(Contract F30602-68-C-0237)
(AD-696693; RADC-TR-69-289) Avail: CFSTI CSCL 17/2

The basic technique of utilizing a dielectric membrane in conjunction with a deformable layer was studied to determine which target configuration could provide the best display characteristics. It was found that a means must be provided to enhance the sensitivity of the control media, such as a metallic mesh attached to the dielectric membrane. The mesh acts to strengthen the force field, conduct the heat created by the electron beam and the absorbed light, as well as mechanically strengthen the target assembly. Some experiments were performed to substantiate the validity of this concept and to get an indication as to what display characteristics could be attained. Results thus far obtained, indicate that large screen display characteristics desirable for military information display can be achieved with this technique. Author (TAB)

N70-17248# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
RADIATION FROM PERIODIC AND LOG PERIODIC STRUCTURES
Johannes Jacobsen Dec. 1967 70 p refs
(Rept-LD-11-b) Avail: CFSTI

Some fundamental properties of radiation from log-periodic antennas were investigated. The basic point of view has been that log-periodic structures may be considered as being produced from the corresponding periodic structure by the application of a linear taper and its properties being described on the basis of k-beta and k-alpha diagrams of the periodic structure. The influence of the different space harmonics of a guided wave on the radiation from log-periodic antennas indicates that the radiation is dominated by the contribution from the $n = -1$ space harmonic. The tapering of the periodic structure was given a mathematical formulation and a description of the near field is given in terms of a simple phase integral approximation of a guided wave. Relations to the far field were obtained by a Kirchhoff-Huygens integration of the pertinent near field which is here taken to be the $n = -1$ space harmonic of the guided wave. An example was studied numerically and results were compared to experimental results. Author (ESRO)

N70-17264# Electro-Voice, Inc., Buchanan, Mich.
HANDSET H-294( )/U Quarterly Report, 1 May - 31 Jul. 1969
B. T. Cochran and A. Bennett Sep. 1969 9 p
(Contract DAAB07-69-C-0173)
(AD-696789; ECOM-0173-2) Avail: CFSTI CSCL 17/2.1

The report contains a summary of the work performed for the design and fabrication of a noise cancelling Handset H294 ( )/U. During the period the cable terminations, switch terminations, microphone and earphone designs have been completed. Author (TAB)

N70-17304# Syracuse Univ. Research Corp., N.Y.
CARIBBEAN UPPER AIR MEASUREMENTS TECHNICAL REPORT 1 OF CARIBBEAN RADIO DUCTING INVESTIGATIONS
R. J. Aldrich, J. R. Herlihy, and L. G. Rowlandson Bedford, Mass. AFSC Aug. 1969 161 p refs
(Contract F19628-69-C-0208)
(AD-697097; ESD-TR-69-366) Avail: CFSTI CSCL 20/4

A series of meteorological measurements was made in the northern part of the Caribbean Sea, during the Spring of 1969, to characterize the Trade Wind Inversion and its effect on radio wave propagation. Among the measurements made were data collected from the sensors on the airborne platform of the USAF C-131 Convair (37812), which was provided for use on this contract. The report is a compendium of some of the airborne data, namely of the magnetic tape analog measurements of air temperature, relative humidity, and radio refractivity recorded during test flights. The values of these parameters herein are relative, not absolute. Also, no corrections have been applied. No interpretations or correlations with other data obtained on the contract are included. Author (TAB)

N70-17352*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
OBLIQUE ECHOES FROM LARGE-SCALE HORIZONTAL GRADIENTS OBSERVED BY ALOUETTE-2 TOPSIDE SOUNDER
Jayaram Ramasastry Washington Jan. 1970 22 p refs
(NASA-TN-D-5596; C-96) Avail: CFSTI CSCL 17B

Loop shaped ionograms observed by the Alouette 2 topside sounder at Ouagadougou, Upper Volta, Africa are presented. The occurrence of loop-shaped traces in the ionograms is due to oblique echoes received by the sounder receiver when the satellite is travelling inside a large scale electron density depression. The oblique returns are caused by total reflection from the walls of the depression region. The minimum or nose frequency and the size of the loop trace are dependent on the structure of the depression region and the horizontal distance of the satellite from the edge of the depression. The loop shaped traces have been observed only in the northern hemisphere in the latitude range 20 deg N-25 deg N and during midnight hours. Author

N70-17399*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
NONLINEAR ANALYSIS AND SYNTHESIS OF GENERALIZED TRACKING SYSTEMS, PART 1
William C. Lindsey Dec. 1968 62 p refs Prepared in cooperation with JPL
(Contract NAS7-100; Grant AF-AFOSR-1622-69)
(NASA-CR-107796; AD-682317; USCEE-317; AFOSR-69-0277TR) Avail:CFSTI CSCL 17I

This report develops a rather general theory for use in the analysis and synthesis of generalized tracking systems. Synthesis procedures for effecting stochastic optimization of a generalized tracker are presented. The results are useful in various applications, e.g., synchronization techniques, radar tracking, missile guidance and navigation, and phase coherent communication systems. Author

N70-17404# Raytheon Co., Wayland, Mass. Equipment Div.
STUDY AND EXPERIMENTATION OF RF PULSE GENERATING AND AMPLIFYING TECHNIQUES FOR IMPROVING RADAR EMISSION CHARACTERISTICS Final Report
H. J. Thomas and H. R. Ward Nov. 1969 199 p refs
(Contract FA-67-WA-1832)
(RD-69-33) Avail: Issuing Activity

The theoretical investigations, designs, fabrication, and testing of a breadboard transmitting system for improving radar emission characteristics is presented. The system, operating in the 2.7 to 2.9 GHz frequency band, consists of a low-level, dual-channel driver and a parallel high-power klystron amplifier stage. The technique produces a shaped pulse with a very narrow spectrum by combining the outputs of two amplifier chains. The chains amplify rectangular pulses which are phase modulated so that when they are combined in a magic-T hybrid, a shaped pulse is formed. Measurements demonstrated that the technique, with its associated equipment, achieved a majority of the specified goals, and, for the most part, the measured results agreed with the mathematical model. Measurements revealed deviations from the mathematical model which are due to gating spikes and signal noise levels. Measurements also showed that long-term drift effects may be stabilized through the incorporation of a long-time constant closed-loop servo network. Results were obtained using a single klystron driven by a shaped output pulse from the dual-channel driver. Author

N70-17420# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
PROJECT LINUS
1969 168 p refs
Avail: CFSTI

Project Linus is a preliminary design study for a farside lunar communications satellite. The purpose of the spacecraft is to support the Apollo mission while it is on the far side of the moon with both voice communications and high bit rate telemetry. Besides being able to provide a communications link during the forty minutes while the Apollo is out of direct earth communications, the satellite has the capability to support a farside landing. Since the moon has a diameter of 3500 km, the satellite will always appear in view of the earth and thus be able to provide the continual communications link with the lunar farside. The orbit however, is slightly unstable so it will have to be periodically corrected during the course of the mission. The 872 pound spacecraft is to be launched from the Eastern Test Range with a three stage thrust augmented Thor Delta rocket in late 1972 and have a lifetime of two years. Power will be supplied by solar panels. Author

N70-17423# Stanford Univ., Calif. Stanford Electronics Labs.
ENGINEERING RESEARCH PROGRAM IN NONCOMMUNICATION NAVAL ELECTRONICS TECHNIQUES Quarterly Status Report, 1 Jun. – 31 Aug. 1969
W. R. Rambo 31 Aug. 1969 24 p
(Contract Nonr-Z25(59))
(AD-696663; SU-SEL-69-056; QSR-33) Avail: CFSTI CSCL 17/4

The following areas of research are summarized: (1) A technique for precision interpulse interval acquisition and tracking suitable for control purposes; (2) Application of self-adjusting voltage filters to adaptive signal sorting; (3) Real-time RF-DF phase-monopulse receiver techniques; (4) Navy consulting; (5) Waveform synthesis and special measurement instrumentation; (6) Solid-state microwave RF sources and companion elements. Author (TAB)

N70-17424# Environmental Science Services Administration, Boulder, Colo. Inst. for Telecommunication Studies.
A SIMULATOR FOR HF ATMOSPHERIC RADIO NOISE
R. M. Coon, E. C. Bolton, and W. E. Bensema Jul. 1969 48 p refs
(ESSA-TR-ERL-128-ITS-90) Avail: SOD $0.50

Performance tests of a radio-communication system under the influence of actual atmospheric radio noise because of its nonstationarity and because of the difficulty in obtaining the desired noise conditions are not feasible. Accurate simulation of desired conditions solves both difficulties. The device described here simulates HF atmospheric radio noise and is modeled after the available published characteristics of such noise, computer-analyzed samples, and empirical observations. The simulation is valid and accurate for the limited samples used. The basic concept of the device is sufficiently flexible that, with adequate statistical data, the several parameters could be adjusted so that the device could simulate any atmospheric radio noise condition likely to occur from ELF to VHF. Author

N70-17522*# General Dynamics/Electronics, San Diego, Calif.
GODDARD RANGE AND RANGE RATE SYSTEM Design Evaluation Report
13 Dec. 1967 379 p refs
(Contract NAS5-10555)
(NASA-CR-107905; R-67-042) Avail: CFSTI CSCL 09F

Objectives and underlying concepts of the Goddard Range and Range Rate system, designed to obtain tracking and telemetry data at VHF and S-band frequencies from spacecraft in a wide variety of orbits, are summarized. The physical and operating characteristics of the modified system are examined. A physical and functional description of each subsystem with its equipment modifications is provided, consisting of the timing, signal generation, transmitter, antenna, receiver, data, and collimation subsystems. The control console, operational test equipment, transponder test set, and system simulator are also described. Design analyses are reviewed for all significant parameters and functions of modulation and signal strength, antennas and receivers, system signal source, range tone tracking, system acquisition, transponder test set, and range, range rate, and angle data errors. Graphical representations of system performance requirements are presented. J.A.M.

N70-17524# Chain Lakes Research Associates, Inc., Detroit, Mich.
DUAL INPUT TRANSPONDER Final Report
Zdzislaw I. Szewczyk Dec. 1968 43 p refs
(Contract FA-67-WA-1781)
(AD-696958; SRDS-RD-68-64) Avail: CFSTI CSCL 17/7

Three Feasibility Models of the Dual Input Transponder (D.I.T.) were built to Specification ER 240-010. The equipment will be used to test one method of eliminating the loss of ATC transponder replies which occurred during aircraft maneuvers when parts of the airframe or engine naceles were interrupting the line of sight between the transponder and the ground interrogator. The D.I.T. is provided with two transmitting receiving antennas located on the airframe in positions such that for almost every aircraft attitude one or the other of the antennas will have an uninterrupted

line of sight to the various ATC interrogators in the range of the D.I.T. equipped aircraft. The interrogating signals arriving at the two antennas are received by two parallel receiver channels and the amplitude of the detected signals compared. Based on this comparison, a decision is made to switch the output of the transponder transmitter to the antenna which has received the larger interrogating signal. Author (TAB)

N70-17542*# Illinois Univ., Urbana.
SEISMIC VEHICLE DETECTION
B. D. Kirkwood, H. W. Knoebel, J. Gooch, and V. C. Metze *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 337-345 (See N70-17526 06-34)
Avail: CFSTI

A telemetered engine clock signal is being used in an attempt to determine if vehicular seismic signals contain well defined frequency components related to engine speed. Preliminary results of an attempt to determine the weight of passing vehicles from an analysis of their seismic signals is described. Author

N70-17588# Selenia S. P. A., Rome (Italy).
TRACKING OF ELDO-PAS SATELLITE WITH 1.7 GHZ ANTENNA [SOLUZIONE DI ANTENNA A 1.7 GHZ PER IL TRACKING DEL SATELLITE ELDO-PAS]
Corrado Zaccagnini 17 May 1968 31 p ref In ITALIAN Sponsored by ELDO
(REPT-RT-68/665) Avail: CFSTI

Proposed solutions for an omnidirectional 1.7 GHz tracking antenna, onboard the ELDO-PAS satellite were evaluated. The solution, based on two diametrically opposed conical spiral antennas was confirmed. Author (ESRO)

N70-17671# Arizona State Univ., Tempe.
DETECTION OF A KNOWN SIGNAL IN WHITE NOISE AND A SPECIAL NONSTATIONARY INTERFERENCE
Lonnie Craig Ludeman (Ph.D. Thesis) 1969 95 p refs
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-5730

The detection of a known signal in the presence of gaussian white noise and nonstationary interference, where the interference is composed of a collection of deterministic signals with random amplitudes and times of arrival, was investigated. By assuming that each of the interfering signals could be approximated by a polynomial in the period of processing, the nonstationary interference has a separable covariance function. The optimal linear processor for the maximization of signal to interference ratio is the solution to a Fredholm integral equation of the second kind. The optimal processor is found to be a correlation receiver where first the received signal is multiplied by the sum of scaled versions of the interfering signals and their derivatives, and then the resulting product is integrated over the desired interval and the output compared with a threshold. Dissert. Abstr.

N70-17719*# IIT Research Inst., Annapolis, Md. System Sciences Research Div.
COMPATIBILITY ANALYSIS FOR THE 1535-1660 MHz BAND, PART 1 Final Report, Jan. - Sep. 1969
Richard L. Martin and Robert A. Paul Oct. 1969 47 p refs
(Contract NAS12-639; IITRI Proj X6908)
(NASA-CR-86268; IITRI-X6908-F) Avail: CFSTI CSCL 17B

The airborne systems that are proposed for allocation in the 1535-1660 MHz band were determined and their external characteristics were identified as completely as possible. Potentially interfering situations were determined. The situations which lent themselves to reasonable analysis were analyzed for the distance separations required between antennas. Where particular characteristics were not specified, such as antenna directivity and patterns, assumptions were made in an effort to avoid either overly pessimistic or overly optimistic results. The general conclusion from this study is that for the proposed frequency allocations, the systems would operate compatibly aboard a relatively large aircraft where the required distance separations could be met. Author

N70-17903 Colorado Univ., Boulder.
AN APPROXIMATE CLOSED-FORM METHOD OF SOLUTION FOR THE DIFFRACTION OF RADIO WAVES BY IRREGULAR SURFACES
Harold Thomas Dougherty (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilm: HC $6.00/Microfilm $3.00 Order No. 69-4358

The tropospheric propagation of radio waves may be considered as wave propagation through a medium that is linear, isotropic, and piecewise homogeneous with irregular boundaries. There is no exact solution to this problem, nor even an approximate theoretical method of solution that we may apply with confidence for telecommunication prediction purposes at microwave frequencies. When irregular terrain and atmospheric layers play a significant role, the approximate methods of solution become increasingly unreliable as the transmission frequency is increased from VHF to higher frequencies. The experience of application and experiment identify the boundary surfaces as a major source of our difficulties. The available approximate methods, eminently suitable for their original purposes, do not now serve this tropospheric problem, either their mathematical assumptions do not apply or their forms become too complicated to evaluate. Dissert. Abstr.

N70-17923 California Inst. of Tech., Pasadena.
PHASE-INCOHERENT FEEDBACK COMMUNICATION
Jerry Butman (Ph.D. Thesis) 1969 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-5683

Nonlinear feedback communication schemes proposed up to now have been restricted to coherent channels. This paper describes a scheme which not only lacks this restriction but yields performance better than the coherent ones that have been analyzed. Block coded orthogonal signals together with incoherent receiver forms are used on both forward and feedback links. It is assumed that the transmitter has a high peak power capability. However, it is shown that by increasing the code length the duty cycle of this mode can be made sufficiently small so that the contribution to average power is negligible. It is found that the probability of error for every message is upper-bounded by $\exp[-E(R)T]$, where T represents the code length and $E(R)$ is a function of the transmission rate, R, the capacities of the forward and feedback channels, and a parameter that determines the rate with which the duty cycle decreases with increasing code length. Dissert. Abstr.

N70-17924 Texas Univ., Austin.
THE DESIGN OF AN ARRAY ANTENNA RADAR FOR DETECTION OF REGIONS OF DISTURBED INDEX OF REFRACTION IN CLEAR ATMOSPHERE
Carroll Riggs Griffin, Jr. (Ph.D. Thesis) 1968 244 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 69-6149

The existing theory of homogeneous turbulence in incompressible fluids is examined and reviewed as a background for the solution of the Maxwell's equations for scattering from turbulent eddies in clear atmosphere. The spectral distribution function for the intensity of refractive index fluctuations is developed with atmospheric refractive index treated as a conservative passive additive to the fluid. An analysis of the effectiveness of the design in terms of detection performance is followed by a chapter devoted to a method of verifying the theory used as the basis for the radar design. This involves the use of airborne instrumentation which simultaneously measures the turbulence parameters that are causing radar back scatter. A theoretical development is presented relating radar cross-section and average aircraft accelerometer measurements, as a parameter proportional to the kinetic energy in the turbulent eddies. Dissert. Abstr.

N70-17958*# Alabama Univ., University. Communication Systems Group.
AM-BASEBAND TELEMETRY SYSTEMS. VOLUME 5: SUMMARY
Richard S. Simpson and William H. Tranter Aug. 1969 142 p refs
(Contract NAS8-20172)
(NASA-CR-102384; TR-108-102) Avail: CFSTI CSCL 09F

The process of coherently demodulating a supressed carrier AM-baseband is analyzed. Carrier synthesis from a pilot and from AM modulated carriers is considered in the presence of additive noise and baseband recorder flutter. The results illustrate the magnitude of phase error in the demodulation carrier arising from each source, and the design parameters which minimize this error. The manner in which automatic gain control affects an AM-baseband system is studied for first- and second-order loops. Tracking error is investigated using an analytical approach for the first-order loop and computer simulation for both first- and second-order loops. Results presented include curves which illustrate the relationship between tracking error and various system parameters. Steady state errors and the dependence of the time constants upon the loop input are also investigated. Author

N70-17971 Pennsylvania Univ., Philadelphia.
TARGET CROSS SECTION MODELS FOR WIDE BANDWIDTH RADAR SYSTEM ANALYSIS
Alfred John Bogush, Jr. (Ph.D. Thesis) 1968 183 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-5612

Target cross section data for single and extended complex radar targets are analyzed. The single target is a conducting body of revolution characterized by a pointed leading edge with a curved convex lateral surface and a spherical trailing edge representative of ballistic targets. A procedure is developed to determine the scattering center amplitudes and separation that combines theory and experiment to obtain estimates for each scattering center for the cross section model. Application of known scattering theory includes a review of scattering from a sphere and cone-sphere at zero aspect and the presentation of a modified physical optics solution for cross section near a maximum. Creeping wave scattering center amplitude and ray paths, significant in the known cross section models for zero aspect are obtained for non-zero aspect from extensive experimentation including monochromatic and short pulse measurements. Dissert. Abstr.

N70-18021 Houston Univ., Tex.
PULSE AND SPECTRUM COMPRESSION IN RADAR SCATTERING
Richard F. Broderick (Ph.D. Thesis) 1968 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-5362

A comparative analysis is performed on the methods of pulse and spectrum compression. The sampling theorem is used to define a spectrum compression ratio which discloses the dependence on the spectral width and shape of the uncompressed doppler spectrum. Experimental results show that the existing concept of the doppler spectrum, that is, a single Gaussian shaped component produced by the antenna pattern and wide-band frequency modulated spectrum from the multitude of Chirp signals is incorrect. An analysis of these results further shows that the doppler return consists of signal components from each the smooth surface and the rough surface, which widen the spectrum and are amplitude modulated as a function of the surface variance and decorrelation distance. The test results also show the present practice of representing radar backscattering cross-section by a single mean curve is misleading as the amplitude modulation index is contained in the variance curves. Also the mean and the variance curves are altitude as well as beam depression angle dependent due to the beamwidth illumination distance. Dissert. Abstr.

N70-18073 Southern Methodist Univ., Dallas, Tex.
ON DIRECTED COMMUNICATION NETWORKS
Robert Dennis Pedersen (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-5520

A communication network may be thought of as a collection of nodes interconnected by links which allow transfer of some commodity between the nodes. A directed communication network is one with links through which flow may occur in only one direction. Several aspects of directed communication networks and results on optimum routing strategies in noisy radio communication networks are presented. Using relationships between link flows and path flows, techniques for optimum routing of several signals simultaneously through noisy radio communication networks are presented. Two optimization criteria are considered. In the first, the object is to maximize information transfer using concepts from information theory. In the second, techniques for minimizing the use of the poorest routes are presented. Both adaptive and nonadaptive networks are considered. Finally a concise technique for developing linear transformations between link flows and terminal flows in double tree networks is presented. Dissert. Abstr.

N70-18087*# National Aeronautics and Space Administration, Washington, D.C.
OPTICAL SPACE COMMUNICATION
Robert S. Kennedy, ed. (MIT) and Sherman Karp, ed. 1969 154 p refs
(NASA-SP-217) Avail: CFSTI CSCL 17B

The results of the workshop on optical communication systems for space applications are reported. Emphasis of the workshop was directed toward digital signaling schemes. It was concluded that with proper design, the performance of a system operating through free space, the atmosphere, or a cloud will continue to improve as the collecting area of the receiver is increased, and the investigation and development of large aperture systems should be intensified. F.O.S.

N70-18105# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE DEVELOPMENT OF THE OMNIDIRECTIONAL RADIO RANGE (VOR) INTO THE DOPPLER-OMNIDIRECTIONAL RADIO RANGE (DVOR)
W. Feyer (Federal Inst. for Air Traffic Control—Frankfurt/Main) Jun. 1969 32 p refs Transl. into English from Luftfahrttechnik Raumfahrttechnik, (Germany), v. 14, 1968 p 186–193 Sponsored by MIT
(Rept-(151)-69-307-GELL) Avail: CFSTI

Long distance navigation in air traffic is based upon the azimuthal course information emitted by an omnidirectional radio range (VOR) in the vhf frequency range. Since this frequency band shows quasi-optical properties, navigational information is falsified by indirect propagations. A development of the principle of the omnidirectional radio range rectified this disadvantage materially with the application of the Doppler effect. The sought after improvement of course-transmission is shown by the results of air surveys. Attempts were successful which had as a goal to expand the Doppler-VOR navigational system with a range finder with a vertical superposed arrangement of the two antenna systems. Author

N70-18107# Queens Univ., Kingston (Ontario). Dept. of Electrical Engineering.
A SIMULATION AND STUDY OF FREQUENCY SHIFT KEYING SIGNALS
David H. S. Ko [1969] 148 p refs
(Contract CD-DRB-513003)
(RR-68-2) Avail: CFSTI

A low frequency simulation of a transmitter for frequency shift keying waves has been constructed. The FM modulator-oscillator is described together with three binary signal sources, the so-called random telegraph, the penny-toss and the ASC2-coded teletype signals, which have been used as models of pulse width modulation.

pulse code modulation, and teletype signals respectively. The transmitter serves as the first part of a transmitting and receiving system for FM signals. A comparison is made of the spectrum of the simulator output with theoretical calculations. The validity of the penny-toss wave as a model for the ASC2 teletype code signals is examined by comparing the FM spectra of the two signals. Author

N70-18183 University of Southern Calif. Los Angeles.
SPEECH SPECTRAL MEASUREMENTS: CONVERGENCE AND APPLICATIONS TO LANGUAGE DISCRIMINATION
David Nathan Sherman (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-6506

Studies of the convergence of the speech spectrum and of the existence of speech spectral differences when the same speaker speaks different languages are the objects of two experiments. In the first experiment, six speakers are recorded speaking for a duration of at least three minutes. The recordings are then digitized and the spectrum computed on an SDS 930 digital computer using fast Fourier techniques. These spectra are then examined for time convergency by using two essentially different metrics, pointwise (filterwise) convergence and convergence of the first four moments of the speech spectrum. Distribution functions of the number of speakers kth central spectral moment is within p percent of their long term moment versus averaging time are constructed. In the second experiment, the spectra of eighteen speakers speaking two different languages are obtained. Half of the speakers speak Chinese (Mandarin) and English, while the other half speak German and English. Three functions of the spectrum are introduced and applied to the obtained spectra. The results indicate that some of the functions are useful in discriminating languages on a known speaker basis, while other functions are used in discriminating languages when the speakers are divided into two categories, native and non-native speakers. Dissert. Abstr.

N70-18197*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RADIO BLACKOUT ALLEVIATION AND PLASMA DIAGNOSTIC RESULTS FROM A 25,000 FOOT PER SECOND BLUNT-BODY REENTRY
Norman D. Akey and Aubrey E. Cross Washington Feb. 1970 96 p refs
(NASA-TN-D-5615; L-6866) Avail: CFSTI CSCL 17B

On October 19, 1967, RAM C-1 was launched aboard a four-stage Scout vehicle. The threefold purpose of the flight experiment was to determine the effectiveness of water injection as a communications blackout suppressant on a spacecraft entering the earth's atmosphere at earth-orbital velocities of about 25 000 ft/sec, to test the effectiveness of an X-band high-frequency telemetry system in reducing blackout time, and to make electrostatic probe measurements of flow field characteristics. Water injection reduced the radio frequency signal attenuation caused by the plasma surrounding the RAM C-1 at altitudes between 260 000 and 135 000 ft. The electrostatic probe measurements were made continuously during the portion of the flight from 290 000 to 200 000 ft and were used to infer electron density distributions in the plasma sheath. The X-band (9210 MHz) telemetry signal was received down to 144 000 ft, approximately 120 000 ft after VHF blackout. Other transmission frequencies were 225.7 MHz, 259.7 MHz, and 5700 MHz. Author

N70-18204# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
TEST AND EVALUATE DUAL DIVERSITY FOR AIRPORT SURVEILLANCE RADARS (ASR) Final Report
Domenick L. Offi Dec. 1969 55 p refs
(FAA-NA-69-50; FAA-RD-69-56) Avail: CFSTI

A frequency divarsity modification was developed for the National Aviation Facilities Experimental Center Airport Surveillance Radar -5 (ASR-5) test bed. The modified system was evaluated to determine the extent of performance improvements realized with this technique. Radar system tests indicated the modification had little effect on normal single channel maintainability, and resulted in an improvement in reliability because of an increase in available radar service. Detection capability tests showed a significant increase in probability of detection for both the analog system, and for the radar video data processor operating in conjunction with the ASR-5. It was recommended that a prototype frequency diversity modification, similar to that employed in these tests, be considered for field implementation. Author

N70-18205# Environmental Science Services Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
INTERFERENCE PREDICTIONS FOR VHF/UHF AIR NAVIGATION AIDS
C. D. Gierhart and M. E. Johnson Nov. 1969 63 p refs
(ESSA-TR-ERL-138-ITS-95) Avail: SOD $0.60

Desired-to-undesired signal ratio predictions for the VHF omnirange and instrument landing system air navigation aids are presented. The parameters involved in these systems are given first. Propagation mechanisms applicable to VHF/UHF and the calculation of transmission loss and its variability are then discussed, and, third, the statistical nature of the desired-to-undesired signal ratio predictions is explained. The results of the study, presented in graphical form, supplement those given in an earlier ESSA report (see N76-31234). In addition to extending the range of variable, the glide slope protion of the ILS is also considered. Author

N70-18274# General Post Office, London (England). Research Dept.
INTERMODULATION DISTORTION IN A BROAD-BAND PARAMETRIC AMPLIFIER HANDLING MULTIPLE FM CARRIERS: EXPERIMENTAL ASPECTS, MAY 1965 – MAY 1967
D. Chakraborty and D. Geden May 1967 49 p refs
(Rept-35) Avail: CFSTI

An experimental investigation was carried out to estimate the amount of intermodulation distortion introduced by a low noise, broadband, nondegenerate parametric amplifier handling multiple f.m. carriers in the presence of a comparatively strong interfering source, e.g. the leakage from the transmitter in a communication satellite earth station. The group delay characteristics of the amplifier were experimentally determined to assess the interchannel crossproducts and harmonic powers in the baseband. The AM-PM transfer coefficient was determined by a precision phase bridge and the measured transfer coefficient was used to evaluate the intelligible crosstalk ratio for different input carrier powers. The correctness of the phase measurement is verified by comparing the derivative of the phase frequency response obtained by the phase bridge method with that from the group delay measurement. Finally the s.h.f. intermodulation products were estimated by a two-carrier i.f. method. Experiments were also carried out with eight carriers centered around 3.9 GHz and a strong transmitter signal at 6.4 GHz. In order to visualize the overall picture, the total power due to eight carriers was progressively increased until the intermodulation spectrum was visible on a s.h.f. spectrum analyser. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-18910*# Missouri Univ., Columbia. Dept. of Electrical Engineering.
FAULT DIAGNOSIS OF OPERATIONAL SYNCHRONOUS DIGITAL SYSTEMS
Michael J. Devaney and George W. Zobrist [1969] 26 p refs

(Contract NAS12-692)
(NASA-CR-86320) Avail: CFSTI CSCL 09B

An original approach partitions the fault diagnosis problem into fault detection and fault location enabling the detection of single and distinguishable multiple faults and the location of these faults down to their defective module or package in order that effective corrective action can be taken. As the anticipated application of this approach is in aerospace systems, effort has been exerted to minimize computer time and storage requirements so that it may operate effectively on a non-dedicated computer in a time-shared environment. The effectiveness of the approach is demonstrated by its application to a Boolean model of the Gemini's Electronic Timer. Author

N70-16918# Institute for Nuclear Physics Research, Amsterdam (Netherlands).
DESCRIPTION OF BOL. PART 10: CENTRAL SCALER UNIT (CSU) [BESCHRIJVING VAN BOL. 10: CENTRALE SCALERS UNIT (CSU)]
J. E. J. Oberski, K. Mulder, L. A. Ch. Koerts, R. van Dantzig, R. F. Rumphorst et al 1969 14 p refs In DUTCH
(Rept-69/3) Avail: CFSTI

Described is the organization and performance of a central scaling unit for the normalization and control of measurements. The unit contains a counting register that processes signals arriving from the coincidence mater besides those coming from the multiple integrator. Results from all measurements are registered on magnetic band at the same time. Transl. by G.G.

N70-17002# Auburn Univ., Ala.
INFORMATION PROCESSING Annual Report, 1 Oct. 1968 - 30 Sep. 1969
Bruce E. Herring, Charles R. White, Joe H. Mize, William H. Bussell, and George H. Brooks 14 Nov. 1969 92 p refs
(Contract DAAH01-68-C-0296)
(AD-696794; AU-T-7; AR-2) Avail: CFSTI CSCL 9/2

An instructors manual for the production control system simulator (PROSIM) has been completed and instructional use of PROSIM has been evaluated. In industrial engineering, several algorithmic programs for computer aided design of production systems have been collected, made operational, and evaluated comparatively. A number of programs are described which contribute to the automation of the machine design process. A report documenting the polynomial manipulation system program has been completed. Research is reported in algorithms for Boolean function minimization, logic design of switching systems, and design of sequential automata. Several reports have been completed. In Physics, a new research area, emphasizing the electronic structure of disordered materials and numerical calculation of the properties of classical statistical systems, has begun. TAB

N70-17057# Institute for Nuclear Physics Research, Amsterdam (Netherlands).
DESCRIPTION OF BOL [BESCHRIJVING VAN BOL]
J. E. J. Oberski, K. Mulder, L. A. Ch. Koerts, R. van Dantzig, R. F. Rumphorst et al [1969] 30 p In DUTCH
(Rept-67/8) Avail: CFSTI

Block diagrams and detailed descriptions for the automatic analog signal processing system of a telescope detector are given. The BOL system panel contains 64 input ports. Every unit consists of a detecting telescope, a logical element, and an ADC element; also included is a central coincidence unit and a sequencer. Every input is connected with both the coincidence unit and the sequencer. The latter provides for the transfer of incoming information near the PDP. Transl. by G.G.

N70-17058# Institute for Nuclear Physics Research, Amsterdam (Netherlands).
PRACTICAL APPLICATIONS OF LISP 1.5 [PRACTISCH WERKEN MET LISP 1.5]
J. A. C. Derksen 7 Dec. 1968 92 p refs In DUTCH
(Rept-69/1) Avail: CFSTI

This programmer's manual describes the operation and application of two listprocessing languages for interpretation purposes. The first system uses a teletype tape puncher and reader, its compiling system functions are simple, and its in- and out-functions are flexible and can be manipulated by character functions. The second system is written for a very small computer; it's fast 12 bid scheme provides good error detection and decoding. Transl. by G.G.

N70-17062# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
ON 4K-CPS: A PROGRAMMING SYSTEM FOR THE PDP-8 SIDE OF THE DEC LINC-8 COMPUTER
Gerald Cederquist and Kurt Metzger Nov. 1969 70 p
(Contract Nonr-1224(36))
(AD-697085; TM-101; Rept-03674-21-M) Avail: CFSTI CSCL 9/2

The 4K-Cooley Programming System (4K-CPS) is a collection of programs designed to aid in programming the PDP-8 side of Digital Equipment Corporations LINC-8 computer. This collection of programs consists of a file system, a loader, a symbolic text editor, and an assembler. These programs are structured so that a user can enter, edit, assemble, load and execute programs entirely from the teletype keyboard. The system architecture is modular, and future components are plugged-in as needed. Author (TAB)

N70-17089# Electronic Associates, Inc., Princeton, N.J. Princeton Computation Center.
HYBRID COMPUTER APPLICATIONS TO MATHEMATICAL MODELS OF PHYSICAL SYSTEMS Final Scientific Report, 1 Jun. 1967 - 31 Dec. 1968
Alfred Engel, Elias H. Hochman, and Lawrence H. Michaels Feb. 1969 163 p refs
(Contract F19628-67-C-0359)
(AD-697088; AFCRL-69-0123) Avail: CFSTI CSCL 9/2

This report describes the applications of hybrid computer techniques to three areas of scientific investigation. The areas investigated were: The effects of perturbative forces on the trajectory of an orbiting satellite, the propagation of electromagnetic energy in the ionosphere, and the track tracing of nuclear emulsions. The text consists of three separate sections, or reports. Each report of an investigation includes discussions relating to: Mathematical modeling, considerations for selecting hybrid approaches, hybrid computer implementation, results of the study, and recommendations. Author (TAB)

N70-17200# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
TWO CHARACTERIZATIONS OF THE CONTEXT-SENSITIVE LANGUAGES
Michael J. Fischer Sep. 1969 16 p refs
(Contract F44620-67-C-0058)
(AD-697040; AFOSR-69-2865TR) Avail: CFSTI CSCL 5/7

An n-dimensional bug-automation is a generalization of a finite state acceptor to n-dimensions. With each bug B, is associated the language L(B) which is the set of top rows of n-dimensional rectangular arrays accepted by B. One-dimensional bugs define trivially the regular sets. Two-dimensional bugs define precisely the context-sensitive languages, while bugs of dimension 3 or greater define all the recursively enumerable sets. Finite state acceptors with n two-way non-writing input tapes are also considered. For each such machine M, let domain (M) be the set of all strings which are the first component of some n-tuple of tapes accepted by M. For any $n > or = 1$, the domains of n-tape finite state acceptors are precisely the same as the languages definable by n-dimensional bugs, so as a corollary, the domains of two-tape two-way finite state acceptors are precisely the context-sensitive language. Author (TAB)

N70-17218# Commissariat a l'Energie Atomique, Bordeaux (France). Centre d'Etudes Scientifique et Techniques d'Aquitaine.
NUMERICAL METHODS FOR ACQUISITION AND ANALYSIS OF VIBRATION TESTS [METHODES NUMERIQUES D'ACQUISITION ET DE DEPOUILLEMENT D'ESSAIS AUX VIBRATIONS]
Didier Babel, Guy Cocchi, and Hubert Oules Nov. 1969 96 p refs In FRENCH; ENGLISH summary
(CEA-R-3307) Avail: CFSTI

The SIDEX is a digital computer assisted facility for data acquisition and processing. It is designed for sine wave or random environment tests, mechanical or acoustical vibrations, and shock waves. The numerical methods and computer programs presently available are described, and examples of results obtained are discussed. Author (ESRO)

N70-17249# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
SUBROUTINE FRMPLT: A NEW VERSION OF ROUTINE EFPLOT
Erik Dragoe Nielsen 28 Apr. 1969 29 p ref
(Rept-S-183; R-71) Avail: CFSTI

A new version of the previously reported subroutine EFPLOT developed for use with a CALCOMP 563 digital plotter is presented. This new version of the plotter routine is called subroutine FRMPLT. When FRMPLT is used in rectangular coordinates, the curves and coordinate system in the graphical output are placed inside a rectangular frame, where ticks are used for marking of the abscissa and ordinate values. The automatic scaling procedure was changed, and a number of other features of the plotter routine were improved. A listing of the FRMPLT routine and samples of graphical plots produced using this routine are given. Author (ESRO)

N70-17255# Institute for Nuclear Physics Research, Amsterdam (Netherlands).
OPTICAL MODEL SEARCH PROGRAMME
H. R. E. Tjin A. Djie and J. A. C. Derksen [1969] 48 p refs
(Rept-69/2) Avail: CFSTI

The optical model search program described here was used for a systematic analysis of 25.9 MeV deuteron scattering by nuclei between C and Au and for deuteron scattering by Ni at various energies between 11.8 and 28 MeV. Good agreement was found with independent analyses of the same data by Perey. The programme was also used to analyze alpha particle data for energies between 12 and 20 MeV and for nuclei between Ne and Ni. Calculations with fixed parameters have shown a good agreement with calculated angular distributions obtained by other authors for 11.8–52 MeV deuterons, for 12–48 MeV alpha particles and for 40 MeV protons by Ni. The X-8 version, called OBAXA (Optical model Brockman Algol X-8) is described in this report. The text of OBATIVIE has been added. Two wavefunction programmes exist at the moment: an asymptotic wavefunction programme (COULAS) which computes with series expansion and a programme which computes the matching radius by numerical integration (COULINT). Experience has learned that the latter method is not always reliable, whereas COULAS gives satisfactory results if the matching radius is large enough. Author

N70-17265# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RANDOMIZATION OF SYMBOL REPETITION OF PUNCH CARDS WITH SUPERIMPOSED CODING IN INFORMATION-SEARCH SYSTEMS
L. Ya. Pirovich 24 Mar. 1969 14 p refs Transl. into ENGLISH from Nauchn.-Tekhn. Inform., Ser. II: Inform. Protessy i Sistemy (USSR), no. 7, 1967 p 21–23
(AD-696606; FTD-HT-23-881-68) Avail: CFSTI CSCL 5/2

The article shows the effect of the irregularity of using separate symbols on search noise on punch cards with superimposed symbol coding in information-search system (IPS). A binomial law of random value distribution of repetition of each symbol is established and analyzed. A method of determining the maximum value of symbol repetition is proposed and an example of calculating this value for an experimental IPS is given. Author (TAB)

N70-17266# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVICE FOR INPUT GRAPHIC INFORMATION TO A COMPUTER
V. S. Vaynshteyn et al 3 Feb. 1969 11 p Transl. into ENGLISH from Vses. Inst. Nauchn. i Tekhn. Inform. Automaticheskoye Chiteniye Teksta (Moscow), 1967 p 176–179
(AD-696613; FTD-MT-24-446-68) Avail: CFSTI CSCL 9/2

A graphic information input device utilizing a phototelegraph apparatus and a voltmeter with digital output, along with appropriate timing and control devices, is described. Analog output from the optical scanner enters the voltmeter and then a Minsk-22 digital computer. TAB

N70-17270# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ARITHMETIC UNIT OF A DIGITAL DIFFERENTIAL ANALYZER WITH SERIES-PARALLEL ACTION
R. V. Korobkov et al 3 Apr. 1969 14 p refs Transl. into ENGLISH from Iz. Vyssh. Ucheb. Aved., Elektromekhan. (Novocherkassk), no. 12, 1967 p 1297–1302
(AD-696615; FTD-MT-24-508-68) Avail: CFSTI CSCL 9/2

An analysis of the main components in an arithmetic unit of a digital differential analyzer with a series-parallel action shows that this type of digital differential analyzer is feasible. The speed of operation is greater than that of a simple series-series analyzer, approaching that of a parallel-series analyzer. Furthermore, it is apparent that this type of digital differential analyzer requires much less equipment than the parallel-series type. These advantages make a digital differential analyzer especially suitable for use in control computers. Author (TAB)

N70-17283# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EDITH CODE. CALCULATION OF THE DYNAMIC AND THERMAL CHARACTERISTICS OF A GAS CIRCUIT IN VARIABLE FLOW CONDITIONS: APPLICATION TO THE STUDY OF THE START-UP OF A REACTOR UNDER NATURAL CONVECTION FLOW CONDITIONS [CODE EDITH. CALCULDES CARARACTERISTIQUES DYNAMIQUES ET THERMIQUES D'UN CIRCUIT GAZEUX EN REGIME VARIABLE: APPLICATION A L'ETUDE DE LA MISE EN REGIME DE THERMOSIPHON D'UN REACTEUR NUCLEAIRE]
Jean-Claude Rousseau and Michel Dobremelle Dec. 1969 34 p refs In FRENCH; ENGLISH summary
(CEA-R-3915) Avail: CFSTI

The momentum equations for the conservation of mass and energy were applied to a closed circuit in which a gas flows, and which includes energy generators, piping, heat exchangers, and blowing equipment. The EDITH computer code makes it possible to obtain, for any point in the circuit, the gas pressure and temperature and the wall temperature, as functions of variations in the power of the generators, the turbo-blowing conditions and the exchanger operational conditions etc. This code can be used to determine the behavior of a nuclear reactor of the natural uranium, graphite, gas type where the heat exchangers are situated underneath the core and become energy generators if the turbo-blowers stop accidentally. The calculation makes it possible to predict instabilities and flow reversals in the circuit which can adversely affect the proper cooling of the reactor. Author (ESRO)

N70-17310# Applied Data Research, Inc., New York, N.Y. Corporate Research Center.
A HANDBOOK ON FILE STRUCTURING Final Report

Robert M. Shapiro, Harry Saint, Robert E. Millstein, Anatol W. Holt, and Stephen Warshall. Sep. 1969. 183 p. refs
(Contract F30602-69-C-0034)
(AD-697025; CA-6908-2331-Vol-1; RADC-TR-69-313-Vol-1)
Avail: CFSTI CSCL 9/2

This report makes an initial attempt at presenting a coherent approach to the design and analysis of file structures. The relative efficiency of different file implementations is discussed as a function of usage statistics. The fundamental differences between item and descriptor-organized files are discussed in terms of input-output requirements. The report concludes with a discussion of batching, buffering and concurrency. Author (TAB)

N70-17340# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
DATA PROCESSING IN AERIAL TRIANGULATION
K. Kubik. *In its* Proc. of the ITC Post-Congr. Seminar. Jul. 1969 p 63-76 (See N70-17335 06-14)
Avail: CFSTI

The subsystems available for block triangulation and the problem of optimizing and controlling the data flow are outlined. Ground control of block and strip triangulation is indicated, and the computations are divided into the following stages: model formation, strip formation, strip adjustment, block formation, and block adjustment. The strip and block adjustment methods are classified into methods with strips, models, and bundles of rays. Quality control and the detection of gross errors are described, and it is pointed out that automatic routines for detecting and eliminating gross errors reduce costs. It is further stated that computational costs can be kept low and are expected to decrease. N.E.N.

N70-17388# Maryland Univ., College Park. Computer Science Center.
GENERALIZED DATA MANAGEMENT SYSTEMS: SOME PERSPECTIVES
Jack Minker. Dec. 1969. 124 p. refs. Sponsored in part by the Auerbach Corp.
(Contract NBS CST-821-5-69)
(TR-69-101) Avail: Issuing Activity

A generalized data management system is a software environment provided as a tool for analysts, administrators, and programmers who are responsible for the maintenance, query, and analysis of a data base to permit the manipulation of newly defined files and data with the existing programs and system. The class of problems addressed by such systems are those in which the problem data in terms of format, number of files, and data structures will not remain stationary over the period of implementation, and there is danger of early obsolescence of the system if it cannot handle data changes for any one application. Some of the developments that have taken place in this technology are reviewed, some characteristics of generalized data management systems are noted, the trends that are likely to develop are explored, and their applicability for management information systems is described. Author

N70-17465*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
CONSTRUCTION OF CONVOLUTIONAL CODES FOR SEQUENTIAL DECODING
Daniel J. Costello, Jr. (Ph.D. Thesis). Aug. 1969. 197 p. refs
(Grant NGL-15-004-026)
(NASA-CR-107868, EE-692) Avail: CFSTI CSCL 09B

A broad look at the problems of convolutional encoding and sequential decoding of digital data for reliable transmission over a noisy channel is presented. Various distance measures for convolutional encoders are carefully defined. A distance measure called the free distance is shown to be a more important parameter for codes used with sequential decoding than the conventional minimum distance. The notion of equivalent encoders is carefully considered, and a new definition of encoder equivalence which preserves the distance properties of the encoder is given. For those nonsystematic encoders that do not have a systematic equivalent which preserves distance properties, a method is presented for converting the encoder to a better systematic encoder. Also, general parity-check matrices and syndrome forming circuits for nonsystematic encoders of all rates are presented. Author

N70-17477# National Physical Lab., Teddington (England). Central Computer Unit.
BABEL, A NEW GENERAL PROGRAMMING LANGUAGE
R. Scowen. Oct. 1969. 55 p. refs
(NPL-CCU-7) Copyright. Avail: CFSTI

BABEL is a high-level computer language which is similar to ALGOL 60. It is more general and can be extended in a logical fashion. The definition of the BABEL language is the compiler which is written in ALGOL 60 and the fundamental units are basic symbols. The BABEL language has been designed so that it is both involuted and natural. Care has been taken to avoid exceptional cases in the rules of the language and some of the features of the language are: a) all entities must be declared, and their scopes are clearly specified; b) there are practically no default options; c) runtime type checks are unnecessary, and type conversions need only be made when the programmer has asked for them; d) a BABEL programme is to be compiled in a single pass without backtracking; e) all incorrect programmes fail. A list of equivalent BABEL and ALGOL forms is also given. Author (ESRO)

N70-17534*# Illinois Univ., Urbana.
COMPUTER
H. G. Slottow, J. Bouknight, G. Crawford, L. Hedges, K. Kelley et al. *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 185-193 *refs* (See N70-17526 06-34)
Avail: CFSTI CSCL 09B

Arithmetic and code checking routines were added to the ILLAR system. The FORTRAN compiler was modified to make subprograms recursive, (i.e., they can call themselves). The CSLx programming package is completed, and the Mitchell 16-mm movie production facility is installed. The display system was modified to provide 256 intensity levels, and a programming system that uses this feature was developed to produce prospective drawings in which hidden planes are eliminated. Examples are shown. Author

N70-17535*# Illinois Univ., Urbana.
PLASMA DISPLAY
D. L. Bitzer, H. G. Slottow, W. Coates, R. Johnson, W. Petty et al. *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 194-225 *refs* (See N70-17526 06-34)
Avail: CFSTI

The appearance of a 128×128 plasma display panel connected to a digital computer is shown. Studies of two on state operation, applications to memory, circuits, field calculations, stability, and color in the plasma display panel are discussed. Author

N70-17537*# Illinois Univ., Urbana.
INFORMATION SCIENCE
R. T. Chien, R. B. Ash, L. Bahl, Y. Chang, D. Cooper et al. *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 238-258 *refs* (See N70-17526 06-34)
(Grant NSF GK-2339)
Avail: CFSTI CSCL 09B

Progress in the area of information processing techniques and systems is reported. Topics discussed include methods of achieving systems reliability through coding, design techniques of digital systems, estimation and filtering, source coding and time continuous channels, information retrieval and communications. Author

N70-17541*# Illinois Univ., Urbana.
COGNITIVE MEMORY
H. von Foerster, R. T. Chien, P. Arnold, K. Bise, B. Carse et al

In its Coordinated Sci. Lab. 1 Aug. 1969 p 296-336 refs (See N70-17526 06-34)
Avail: CFSTI CSCL 09B

Fundamental properties of perceptive cognition are investigated. Semantic techniques for parsing and compiling are developed. Architecture of an associative processor is presented. Other progress relating to cognitive structures is also reported. Author

N70-17544*# Illinois Univ., Urbana.
PHOTOCHROMIC MEMORY FOR COMPUTER APPLICATIONS
H. Knoebel, W. D. Compton, V. Krone, and J. Burt *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 349-351 refs (See N70-17526 06-34)
Avail: CFSTI CSCL 09B

A proposed mechanism for using M sub A color centers in a write, erase, and nondestructive read out memory system is described. Author

N70-17613# Houston Univ., Tex. Dept. of Computer Science.
GRASPE 1.5: A GRAPH PROCESSOR AND ITS APPLICATION
Daniel P. Friedman, David C. Dickson, John J. Fraser, and Terrence W. Pratt Aug. 1969 148 p refs
(Contract N00014-68-A-0151; Proj. Themis)
(AD-696673; RS-1-69) Avail: CFSTI CSCL 9/2

A set of primitives to allow graph processing on a list processing system is investigated. The object of the investigation is to provide a method of applying intuitive graph solution techniques to graph oriented computer problems. Applications are presented from several disciplines. Author (TAB)

N70-17628*# IIT Research Inst., Chicago, Ill. Dept. of Electrical Engineering.
APPLICATION OF NASAP TO THE DESIGN OF COMMUNICATION CIRCUITS
K. J. Rooney and E. W. Weber 30 May 1969 166 p refs
(Contract NAS12-650)
(NASA-CR-86315) Avail: CFSTI CSCL 09B

This report describes the modification made to the CDC 3600 NASAP version 1.1 to: (1) permit it to function with F level Fortran 4 on the IBM 360/40 computer system, and (2) make it more useful than the original version for the design of linear communication circuits. The use of this version with coding rules and examples, the program modifications, flow graphs of the added subroutines and a printout of the program are described. A discussion of the original program is included. Author

N70-17633# Illinois Univ., Urbana. Dept. of Electrical Engineering.
CASCADES OF TRANSFORMATIONS OF TWO DIMENSIONAL DISTRIBUTION FUNCTIONS
Larry J. Peterson 15 Jun. 1969 52 p refs
(Contract AF 33(615)-3890; Grant AF-AFOSR-7-67)
(AD-696151; (BCL-5-9) Avail: CFSTI CSCL 9/4

Preprocessing of visual information is discussed. Features are extracted from a distribution function through successive applications of analog transformations and an analysis is given of the feature extracting abilities of the Visual Image Processor. Cascades of non-linear transformations are discussed and it is shown that a system of cascaded transformations of analog functions is a subset of the class of cascaded non-linear transformations. Author (TAB)

N70-17883# Oxford Univ. (England). Nuclear Physics Lab.
DATA HANDLING AND ON-LINE COMPUTING IN THE OXFORD ELECTROSTATIC GENERATOR LABORATORY
K. W. Allen *In* EURATOM Panel Discussion on Future Trends in Phys. Meas. and Nucl. Instr. Oct. 1969 p 1-4 refs (See N70-17882 06-24)
Avail: CFSTI

The computer system used to process data from accelerator experiments is described. When the system is complete, two on-line experimenters and one background user will be serviced by the time shared system. The development from a PDP-7 to the addition of a PDP-10 is reviewed. A display system with direct access to memory was chosen. Computers are scheduled at the same time that accelerators are scheduled, and computer shutdowns are planned as far as possible to coincide with experiments not requiring on-line facilities. Kicksorters are used for experiments involving a great deal of output, and a digital event selector is used to determine which ADC outputs are to be processed. N.E.N.

N70-17886# Rudjer Boskovic Inst., Zagreb (Yugoslavia).
CYBERNETICS IN THE LABORATORY
B. Soucek *In* Euratom Panel Discussion on Future Trends in Phys. Meas. and Nucl. Instr. Oct. 1969 p 27-44 refs (See N70-17882 06-24)
Avail: CFSTI

Nuclear applications of coding, transformation, selection, simulation, filtration, learning, and feedback for nuclear research are discussed. Linear feedback shift register codes for calibrating nuclear instruments are described. A method is given for a million-channel pulse-height analysis using pseudorandom digital transformation. The extraction and selection by an on-line computer of the most probable items and of items with more information are illustrated. The operation yielding the probability distribution through the Poisson weighted sum of the n-fold convolutions is described for use in nuclear pulse spectroscopy, and the probability density function is treated as a pulse shape. Computerized simulation is applied to nuclear stochastic signal processing. N.E.N.

N70-17888# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Centre.
REPORT ON THE PANEL DISCUSSION AT ISPRA, MAY 9, 1969
L. Stanchi *In its* Panel Discussion on Future Trends in Phys. Meas. and Nucl. Instr. Oct. 1969 p 55-64 refs (See N70-17882 06-24)
Avail: CFSTI

Data processing aspects of nuclear research are discussed, emphasizing digital data. It is pointed out that the use of germanium detectors has increased the need of digital circuitry, computing power, and computing time to handle data, and the problem of resolution is mentioned. Efforts in nuclear laboratories center on data handling and on-line computing techniques. Details are given on computer aided circuit design and the use of computers in investigations of stochastics processes, ion implantation, opto-electronics, and X-ray characteristics. N.E.N.

N70-17918# Defense Documentation Center, Alexandria, Va.
MACHINE-AIDED INDEXING Technical Progress Report, Jan. 1967-Jun. 1969
Paul H. Klingbiel Jun. 1969 28 p refs
(AD-696200; DDC-TR-69-1) Avail: CFSTI CSCL 5/2

A partial syntactic analysis is used to detect words and phrases in contexts which make them useful for indexing purposes. For instance, the word abstracted is useful only when it functions as an adjective. A total of 97,425 words of text were run through the index programs in three minutes and forty seconds on the UNIVAC 1108 under EXEC I. The output is being analyzed to detect synonyms and to compare the machine-produced index terms with manual indexing assignments. At least 500,000 words of text will be processed to obtain statistics to determine whether the system is competitive with manual indexing. (Author) At least 500,000 words of text will be processed to obtain statistics to determine whether the system is competitive with manual indexing. Author (TAB)

N70-18039# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
A LIMITED-VOCABULARY, MULTI-SPEAKER AUTOMATIC ISOLATED WORD RECOGNITION SYSTEM
James E. Paul, Jr. 1 Sep. 1969 158 p refs
(Contract F44620-69-C-0033)
(AD-696206; AFOSR-69-2776-TR) Avail: CFSTI CSCL 6/4

Techniques for automatic recognition of isolated words are investigated, and a computer simulation of a word recognition system is effected. The following aspects of the system are considered in detail, data acquisition and digitizing, word detection, amplitude and time normalization, short-time spectral estimation including spectral windowing, spectral envelope approximation, parametric and adaptive feature extraction, and pattern classification A method of time normalization is developed and is shown very effective in reducing recognition error rates. Recognition parameters are derived from estimated short-time power spectra. An evaluation of spectral windows is made resulting in the selection of the hanning window. Fourier transformation of finite length time series is discussed along with the modified periodogram. A convolutional smoothing method of spectral envelope approximation is developed, and several smoothing windows are compared. Features are extracted from partitioned intervals over the spectral envelopes. The boundaries of these intervals are determined using both parametric and adaptive procedures. Formant orientation is found effective for the parametric boundaries. An improved measure of feature merit is developed and is compared with both the information and analysis-of-variance criteria. The overall word recognition system was found to perform very satisfactorily with recognition accuracies reaching 99 percent for a single speaker, 50-word vocabulary and 96 percent for a three-speaker, 30-word vocabulary. Author (TAB)

N70-18042# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
DEVELOPMENT OF MATHEMATICAL MODELS FOR HYBRID COMPUTATION, VOLUME 1 Final Report, 1 Oct. 1967 - 31 Oct. 1968
Robert J. Mc Laughlin and Alfred A. Pandiscio Apr. 1969 324 p refs
(Contract F19628-68-C-0042)
(AD-696098; AFCRL-69-0212-Vol-1) Avail: CFSTI CSCL 9/2

The work described in the report had three objectives. First, to select a number of realistic physical problems and develop mathematical models suitable for solution on both analog and digital computers. Second, to develop successively more complete versions of one of the models to determine its suitability for solution on a hybrid computer. Third, to examine the utility of the parallel logic capabilities of an otherwise conventional modern analog computer. Some five models of problems arising from the dynamic behavior circulatory and respiratory control systems were programmed and solved on a digital computer. Three were also solved on an analog computer. A digital detection system was simulated with emphasis given to utilizing parallel logic. The most elaborate of the respiratory models considered is recommended for further investigation on a hybrid computer. Author (TAB)

N70-18214# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODELS VMP-2, VMA-2, AND VILNYUS COMPUTERS, SELECTED PARTS
E. M. Minkovskii et al 20 Jan. 1969 4 p Transl. into ENGLISH from 'Vychislitelnyye Mashiny Modeley VMP-2, VMA-2 i Vilnyus', USSR, 1967 p 5-10
(AD-696614; FTD-MT-24-471-68) Avail: CFSTI CSCL 9/2

The booklet is intended as a textbook in studying operational techniques of multikey calculators of Soviet manufacture, such as Schetmash models VMP-2 and VMA-2, and 'Vilnyus'. TAB

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-16927 National Lending Library for Science and Technology, Boston Spa (England).
FIELD EFFECT TRANSISTORS IN ELECTRONIC CIRCUITS
Zdenek Lukes 18 Jul. 1969 20 p refs Transl. into ENGLISH from Slaboproudy Obzor 29 (Prague), no. 4, 1968 p 222-229
(NLL-Trans-2572-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

Possibilities of using field effect transistors in some branches of electronics are analyzed. It gives basic circuits, setting of the working point, and a simple amplifier example. Circuits of source followers and a number of examples are given with field effect transistors in input circuits (charge-sensitive preamplifiers, electrometers, etc.) and in some types of amplifiers. The drawbacks of field effect transistors are discussed (as compared with bipolar transistors). Author

N70-16944# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
A RADIATION EFFECTS RESEARCH PROGRAM UNDER THE PROJECT THEMIS Annual Report, 1 Mar. - 31 Aug. 1969
W. W. Grannemann, R. C. Allen, Jr., L. T. Boatwright, W. J. Byatt, H. D. Southward et al Sep. 1969 206 p refs
(Contract N00014-68-A-0158)
(AD-696680; EE-167(69)ONR-005) Avail: CFSTI CSCL 18/8

Radiation effects research has been directed toward basic problems with dielectric materials, semiconductor materials, and solid-state devices, such as: Electron transport in a one-dimensional solid, Small-signal s-parameters for high-frequency transistors, Light-emitting diodes, laser diodes, and the gallium-arsenide material used in the construction of the diodes, Technology for making micro-Hall devices, Metal-oxide-silicon capacitors with guard rings, Dielectric Hall effect devices of microcircuit size, Avalanche theory, Four-layer silicon-controlled rectifiers, Schottky barrier diodes fabricated on silicon and gallium phosphide, and Fabrication of small radiation-resistant devices. Author (TAB)

N70-16995# Army Electronics Command, Fort Monmouth, N.J.
QUARTZ VIBRATOR PARAMETER DETERMINATION BY PARALLEL BRIDGE METHODS
George R. Oliva, Jr. and Arthur Ballato Aug. 1969 56 p refs
(AD-697110; ECOM-3121; OSD-1366) Avail: CFSTI CSCL 9/1

Bridge methods are the most accurate means of determining the parameters of quartz vibrators, particularly in the VHF region, and above. Present and future crystal requirement specifications point toward the increasing use of such methods to obtain the accuracy necessary for both filter and oscillator applications. A practical difficulty which arises is that the ranges of any given bridge are not compatible with every immittance characteristic encountered with the various crystal types in use, particularly if measurements are to be made over substantially different portions of the region of resonance. One means of obviating this difficulty is to augment the crystal with another impedance element in series or parallel so that the behavior of the combination is accommodated within the bridge ranges; the value of the augmenting element is determined separately, usually on the same bridge. Thus a capacitance in parallel with the crystal is suitable for reducing the impedance variation when using impedance bridges which consider the unknown as a series combination of resistance and reactance, while a series element reduces the admittance variation in parallel bridges--those representing the unknown as a conductance and susceptance in parallel. It is one purpose of this technical report to discuss the applicability and limitations of this latter procedure, and describe

how the crystal parameters are extracted from measurements of this type. Author (TAB)

N70-17016# Army Foreign Science and Technology Center, Washington, D.C.

CALCULATION OF DISTRIBUTION OF FEED CURRENT OVER THE SURFACE OF A SLOT ANTENNA

V. S. Degtyarev 29 Oct. 1969 11 p refs Transl. into ENGLISH from Radiotekhnika, (USSR), v. 21, no. 3, 1966 p 84–88
(AD-697072; FSTC-HT-23-311-69) Avail: CFSTI CSCL 9/5

This article presents a method of calculating the distribution of feed current over the surface of a slot antenna. The distribution of feed current must be known in order to determine resistance loss and antenna efficiency. Author (TAB)

N70-17017# State Inst. for Technical Research, Helsinki (Finland).

EXPLANATION OF THE PROPERTIES OF THE THIN-FILM TRANSISTOR

Ralf Graeffe (Ph.D. Thesis—Inst. of Tech., Helsinki) 1969 38 p refs
(Publ-148) Avail: CFSTI

A new model was developed for the mechanism of the thin film transistor, valid in both enrichment and depletion mode. In the model it is assumed that Petritz' barrier model is valid for the conduction mechanism in the semiconductor film. The effect of the semiconductor film thickness was considered according to Neumark's method. The new model can explain the frequently mentioned discrepancies between the Hall mobility and the field-effect mobility in thin film transistors. The model was verified by measurements on depletion-type cadmium selenide thin film transistors. Author

N70-17066# Naval Research Lab., Washington, D.C. Mathematics and Information Sciences Div.

DIGITAL DIAGNOSTIC TECHNIQUES: SURVEY AND RECOMMENDATIONS

William R. Smith 2 Oct. 1969 19 p refs
(AD-696934; NRL-6938) Avail: CFSTI CSCL 9/2

Finding efficient testing procedures for digital machines has become of prime concern to the industry due to high circuit densities brought about by evolution in semiconductor device technology. The number of inputs required for testing can be reduced from the set of all possible input combinations to a smaller group derived from a dictionary of tests which defines unique relationships between failure mode and output response. Reduction of the test dictionary by prime-implicant minimization methods and by serial application of the reduced set can lead to manageable test programs. These involve sequence lengths characterized by a lower limit, bounded by the logarithm of the number of initial table entries. Author (TAB)

N70-17070# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.

RESONANCE PHENOMENA IN PIEZOELECTRIC VIBRATORS

Arthur Ballato Sep. 1969 16 p refs
(AD-697114; ECOM-3181) Avail: CFSTI CSCL 9/1

A most distinguishing and useful feature of lightly damped piezoelectric vibrators is the comparative sharpness of the mechanical resonances which may be excited. Consideration of the electrical behavior of a simple vibrator of this type leads to various criteria by which to describe the onset and extent of the region of resonance. It is shown that the equiimmittance point is a most convenient criterion for delimiting the resonance range, and, further, provides a measure assessing the validity of circle diagram representations. A comprehensive list of characteristic frequencies associated with the vibrator resonance is given with corresponding equations for their determination. Author (TAB)

N70-17102# North Carolina State Univ., Raleigh.

A STUDY OF ANTENNA SYNTHESIS Final Report, Apr. 1967 – Sep. 1969

Donald R. Rhodes 15 Sep. 1969 12 p refs
(Contract F19628-67-C-0255)
(AD-696101; AFCRL-69-0439) Avail: CFSTI CSCL 9/5

The objectives and present status of the antenna synthesis study are reviewed. The results of two scientific reports issued in the course of the present study, one on a physical foundation for electromagnetic system theory and the other on the spheroidal functions of the first kind, are summarized briefly. Author (TAB)

N70-17104# Naval Avionics Facility, Indianapolis, Ind.

THE REPAIR OF DEFECTIVE IMBEDDED CIRCUITRY IN ELECTRICAL INSULATING MATERIALS

William M. Shank Oct. 1969 35 p
(AD-696965; NAFI-TR-1329) Avail: CFSTI CSCL 9/5

A method of repairing faults and making design changes in multilayer boards and other items with imbedded electrical circuitry is described. Author (TAB)

N70-17115# Army Foreign Science and Technology Center, Washington, D.C.

APPLICATION OF THE METHODS OF COHERENT OPTICS AND HOLOGRAPHY TO THE PROBLEMS OF ANTENNA ENGINEERING AND DATA PROCESSING

L. D. Bakhrakh et al 15 Oct. 1969 29 p refs Transl. into ENGLISH from Antenny (USSR), no. 2, 1967 p 33–54
(AD-697076; FSTC-HT-23-081-70) Avail: CFSTI CSCL 9/5

The article examines the possibilities of applying the methods of coherent optics and, in particular, of holography to the problems of antenna engineering and data processing. With the aid of the methods of coherent optics it is expedient to do the optical simulation of antennas, the restoration of the radiation patterns of antennas by the measurements of the field in Fresnel region, etc. In the realization of a system with a synthesized aperture the use of holography principles proves to be the most natural. The application of the methods of holography and matched optical filtration for image discrimination is especially effective. Author (TAB)

N70-17137# Pennsylvania State Univ., University Park. Ordnance Research Lab.

A VARIABLE-REFERENCE-LEVEL CORRELATOR

J. A. Macaluso 15 Sep. 1969 27 p refs
(Contract NOw-65-0123-d)
(AD-695408) Avail: CFSTI CSCL 9/5

The design and preliminary performance characteristics of a variable-reference-level correlator (VRLC) are described. This unique instrument utilizes the basic circuitry of a digital polarity-coincidence correlator but, by comparatively simple modifications, permits an output to be obtained that is related not only to the phase coincidence of the inputs but to their amplitudes as well. The VRLC has been successfully employed in an experimental program to study the correlation properties of the underwater diffraction pattern of a corrugated air/water interface. Author (TAB)

N70-17141# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE USE OF RHENIUM AND ITS ALLOYS IN ELECTRONIC VACUUM DEVICES

A. V. Kiselev and V. P. Kikonov 23 Apr. 1969 17 p refs Transl. into ENGLISH from Vsesoyuznoe Soveshch. Po. Probl. Reniya 2nd, (Moscow), 1962
(AD-696171; FTD-MT-24-101-69) Avail: CFSTI CSCL 9/1

The article reviews the applications of rhenium and its alloys in cathode electronics and their use as structural parts of electronic devices, etc. The properties of rhenium as a thermionic emitter are discussed and compared to those of tungsten, tantalum, and molybdenum. The emissive properties of rhenium-barium cathodes are described. The uses of rhenium as base material for

high-temperature cathodes are treated at length; the thermionic emission characteristics of rhenium-, tantalum-, niobium-, and molybdenum-base cathodes coated with thorium oxide, yttrium oxide, lanthanum oxide, and europium oxide are compared. Rhenium is also discussed as a field emitter, and as a material for heating elements when it is alloyed with tungsten. TAB

N70-17143# Army Foreign Science and Technology Center, Washington, D.C.
OPTIMAL PARAMETERS OF AN ARTIFICIAL DELAY LINE
Yu. L. Bogorodskii and L. G. Lishin 22 Oct. 1969 17 p refs Transl. into ENGLISH from Vsesosuznyi Nauch.-Issled. Inst. Magnitnoizapisi i Tekhn. Radioveshchaniha i Televideniya, Tr., (USSR), no. 5, 1967 p 139–146
(AD-696917; FSTC-HT-23-677-69) Avail: CFSTI CSCL 9/1

The possibility of developing an artificial delay line, based on low-frequency filtering, is investigated. These lines are used in certain video tape recorders in order to correct quadrature errors. Basic factors which influence the choice of line parameters are examined and a technique is proposed for optimum line design which provides for high-quality video-recording correction. Author (TAB)

N70-17159# Signals Research and Development Establishment, Christchurch (England)
CONTRAST-ENHANCEMENT IN IMAGING DEVICES BY SELECTION OF INPUT PHOTOSURFACE SPECTRAL RESPONSE
E. A. Richards Jan. 1969 20 p Presented at the Symp. on Photoelectron. Imaging Devices, London, 16-20 Sep. 1968
(AD-696930; SRDE-69009) Avail: CFSTI CSCL 9/1

When viewing distant terrain scenes in daylight, improvement in perception-range and contrast can be obtained using near-infrared photography. This is due to the increased reflectivity of vegetation and better haze-penetration at the longer wavelenths. At night-time, however, photographic emulsions are too insensitive and intensification of the image is essential if a record is to be made. Since the spectral distribution of the illumination changes considerably between moonlight and starlight conditions (and terrain materials possess individually different spectral reflectivity characteristics) the apparent contrast and signal-level registered by the image-intensifier also depend on the spectral response of the input photosurface. The performances of four hypothetical imaging systems, each having significantly different input spectral responses (i.e. an S20 photocathode, a caesiated GaAs photocathode, Si and intrinsic Ge photoconductors) are compared when surveying representative terrain materials (a) under full moonlight illumination, and (b) under clear starlight illumination. Author (TAB)

N70-17196# Selenia S. P. A., Rome (Italy).
PRELIMINARY ANALYSIS OF COMMAND DECODER RELIABILITY [ANALISI PRELIMINARE DELLA FIDATEZZA DEL COMMAND DECODER]
V. Delfa 30 Aug. 1968 14 p In ITALIAN Sponsored by ELDO
(Rept-RT-68/729) Avail: CFSTI

This report deals with reliability calculations on the telecommand of the ELDO launch vehicle (FB configuration). Possible degraded states of the system were characterized, and the probability of their occurrence was calculated. Electrical extremes for the circuit elements were also verified. ESRO

N70-17226# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
SAMPLING SYSTEM FOR FAST SINGLE PULSES [REALISATION D'UN DISPOSITIF D'ECHANTILLONAGE D'UN SIGNAL BREF UNIQUE]
Daniel Zenatti (Ph.D. Thesis – Grenoble Univ., 4 Oct. 1967) Sep. 1969 50 p refs In FRENCH; ENGLISH summary
(CGA-R-3812) Avail: CFSTI

A device was developed for the wider application of classical oscilloscopes to the observation of fast single pulses by using sampling principles. Author (ESRO)

N70-17251# Signals Research and Development Establishment, Christchurch (England).
THE DESIGN OF AN EXPERIMENTAL GYRATOR
F. W. Abbott Feb. 1969 26 p refs
(SRDE-69013) Avail: CFSTI

Design of an experimental gyrator circuit is described using discrete components for a grounded inductance simulation over the frequency range 100 Hz to 50 kHz. An ungrounded inductance may be simulated by the use of two such identical gyrator circuits or by the use of a gyrator flotation circuit with one gyrator. Maximum figures of about 280 are obtained, and the circuit was tested over the temperature range 20 C to 50 C with good results. Some of the transistors used were germanium, because these were readily available but with slight adjustments to biassing points the entire gyrator can be built using silicon devices. In this latter form, it should be possible to produce an integrated circuit. Author (ESRO)

N70-17282# TRG, Inc., Menlo Park, Calif.
DEVELOPMENT AND TESTING OF HF WIRE-GRID LENS ANTENNA, VOLUME 3 Final Report
E. M. T. Jones Dec. 1968 112 p refs
(Contract FAA-ARDS-598)
(AD-696960; SRDS-RD-68-26-Vol-3) Avail: CFSTI CSCL 9/5

The report describes the results of a series of measurements made on the FAA multi-beam Wire- Grid Lens HF Antenna Located at Molokai, Hawaii during the summer of 1967 to determine its message traffic-handling capacity when equipped with optimized feeds. Error rate measurements were made of signals received on the lens operating simultaneously in the simplex mode and the angle-diversity mode in which a signal is simultaneously received on a pair of beams pointing in slightly different azimuth directions. The tests were carried out by TRG under the overall supervision of FAA and AFCS representatives. The median binary error rate for the simplex mode of operation was found to be 0.00033, while the median binary error rate for the angle-diversity mode of operation was found to be 0.000027 which represents a 12 to 1 improvement. Optimized feed binary error rate measurements were also made on circuit 100 wpm radioteletypewriter signals alternately received on the lens and a station rhombic for comparison with the error rates. The essential test conditions of the previous tests were duplicated. The simplex binary error rate ratio of the lens to a rhombic was found to be 2.5 to 1 favoring the rhombic. Author (TAB)

N70-17300*# Deutsch Relay Div., East Northport, N.Y.
STUDY OF THE PARAMETERS AFFECTING CONTACT PERFORMANCE OF HIGH RELIABILITY RELAYS
Charles P. Nunn and S. Bradford Mc Rickard Sep. 1969 68 p refs
(Contract NAS12-634)
(NASA-CR-86321) Avail: CFSTI CSCL 09A

The process, contamination, and contract material parameters that are known to affect the electrical contact performance of high reliability, crystal-can type relays were studied. The study was built around the sealed switching module contract system which, by virtue of its design, eliminated the gross effects of the coil assembly from the contacts, thereby providing an organic free contact module. A fundamental failure mechanism was found on the gold plated, silver substrate contact system when operated under extremely dry conditions. Cold welding of the contacts would occur after 30,000 operations due to mechanical wear through the gold plate and exposure of the soft silver-palladium alloy substrate material. The basic material failure mode was eliminated by the introduction of a 2-5 micron, electroplated rhodium contact system. Author

N70-17302*# Sperry Rand Corp., Clearwater, Fla. Microwave Integrated Modules Dept.
MICROWAVE MICROELECTRONIC TECHNIQUES APPLIED TO PHASE SHIFTERS AND OTHER CONTROL DEVICES
Final Report, 29 Jan. 1968 – 29 Aug. 1969
G. H. Robinson Nov. 1969 117 p refs
(Contract NAS8-21268)
(NASA-CR-102421; SJ-221-5282-20) Avail: CFSTI CSCL 09A

The development of microwave phase shifters and other microwave control devices in microelectronic form is described. The effort has included analytical studies and experimental investigations of materials and devices for application to microwave signal control and processing functions. Particular emphasis has been placed on utilization of the unique properties of ferrimagnetic materials. Author

N70-17314*# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF ION IMPLANTATION TECHNIQUES FOR MICROELECTRONICS
H. L. Lunlap, R. G. Hunsperger, and O. J. Marsh Oct. 1969 89 p refs
(Contract NAS12-124)
(NASA-CR-107875) Avail: CFSTI CSCL 09A

SiC p – n junction diodes operate very well between room temperature and 400 C. These are abrupt p – n junctions (when properly annealed) without the intrinsic layer observed in nearly all previous work. N – type layers can be made in p – SiC by implanting N, P, and Sb under much milder anneal conditions than those required for other doping techniques. P and Sb doping have not been achieved previously in SiC. The intrinsic layer observed in implanted junctions arises from defects associated with As vacancies produced during implantation and annealing. The intrinsic region can be controlled or eliminated by the use of a SiO compound protective coating during implantation and annealing, and by implanting at room temperature. The amount of lattice damage is measured as a function of dose created when Cd is implanted in GaAs. The annealing behavior in the high and low dose regimes was established. Author

N70-17363# Royal Aircraft Establishment, Farnborough (England).
AN EXPERIMENTAL CYCLO CONVERTOR
R. J. K. Splatt Oct. 1967 54 p refs
(RAE-TR-67270) Copyright. Avail: CFSTI

A 2 phase cyclo converter whose output frequency can be varied between 1/4 and 100 Hz is described in detail. It is capable of supplying power to resistive and inductive loads or for controlling the speed of an 8 hp induction motor. Author (ESRO)

N70-17397# Institute of Technology, Helsinki (Finland).
VOLTAGES BETWEEN THE NEUTRAL OF AN UNLOADED TRANSFORMER AND THE EARTH IN AN EFFECTIVELY EARTHED RIGIDE NETWORK DURING NONSIMULTANEOUS CLOSING OF PHASES
Matti Karttunen (Ph.D. Thesis) 1969 158 p refs
Avail: CFSTI

A study is presented of overvoltages between the insulated neutral and earth in three-legged transformers with cores of grain-oriented steel. The limits that single-phase and double-phase switching impose on the choice of insulation level for a neutral are ascertained, as well as the magnitude of transients at the moment of switching. The magnetizing properties of the transformers and an equivalent circuit for the magnetizing impedance are discussed along with the capacitance of the network and transformers. Voltages between the free phase and earth, and transients at the moment of switching were numerically calculated by integration. J.M.

N70-17408# Laboratori Elettronici e Nucleari, Milan (Italy).
DIGITAL DATA ACQUISITION SYSTEM AS ON-BOARD INSTRUMENTATION FOR SCIENTIFIC SATELLITES
Umberto Pellegrini *In* ELDO/ESRO Tech. Rev., Vol. 1, No. 3 1969 p 301 – 336 (See N70-17406 06-34)
Avail: CFSTI

A survey is made of on-board instrumentation systems for data acquisition in order to combine a number of existing functional blocks to obtain configurations and performances to meet the requirements of a variety of space missions. This leads to economy in instrumentation development costs which are very high due to the degree of reliability required even for prototypes. The test blocks are designed to offer flexibility for systems connection and are constructed using hardware techniques enabling specifications to be changed by simply replacing components or parts without the need for re-designing all the blocks or printed circuits. System configurations are described relating to ELDO satellites in launching and orbital phases, to deep space probes, and ESRO TD-1 satellites. Author (ESRO)

N70-17478# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
ELECTROMAGNETIC PROCESSES IN CONVERTING DEVICES
I. G. Bobrysheva, ed. 1967 213 p refs In RUSSIAN
Avail: CFSTI

Electromagnetic and transistorized frequency converters and modulators are considered, as well as voltage and current stabilizers and magnetic suspension devices. Calculating formulas are derived for designing the indicated devices. For individual titles, see N70-17479 through N70-17510.

N70-17479# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
POSSIBILITY OF DESIGNING FREQUENCY CONVERTERS
A. N. Milyakh and R. P. Kartashov *In its* Electromagnetic Processes in Converting Devices 1967 p 11 – 17 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The problems of designing frequency converters are considered on the basis of applying the unipolar modulation method. An analysis is conducted of circuit diagrams for generating unipolar oscillation by the phase compensation method. Transl. by H.W.

N70-17480# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
FREQUENCY CONVERTERS BASED ON THREE-PHASE PHASE REVERSAL
R. P. Kartashov and V. S. Fediy *In its* Electromagnetic Processes in Converting Devices 1967 p 18 – 27 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The problems of applying the method of phase reversal are discussed for the purpose of converting the frequency of multiple-phase power sources. A harmonic analysis device is used for studying expressions of voltage. Transl. by H.W.

N70-17481# Akademiya Nauk URSR, Kiev. Inst. Termofiziki i Elektrofiziki.
OPTIMUM PARAMETRIC RELATIONSHIPS OF CERTAIN INDUCTIVE CIRCUITS FOR SEPARATING THE ENERGY OF THE VARIABLE COMPONENT FROM PULSATING VOLTAGE
V. V. Sarv *In its* Electromagnetic Processes in Converting Devices 1967 p 28 – 34 In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

Results are presented of investigating circuits with an inductive energy accumulator for separating the variable component from pulsating voltage. Circuits with linear ballast resistance and inverse voltage are considered. It is shown that efficiency may be increased by changing the shape of the pulsating voltage. Transl. by H.W.

N70-17482# Kiev Polytechnic (USSR).
PROCESSES OCCURRING IN A TRANSISTORIZED FREQUENCY CONVERTER

Ye. F. Doronkin and V. A. Fedorenko *In* Akad. Nauk URSR Electromagnetic Processes in Converting Devices 1967 p 35–39 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

Processes occurring in a transistorized device for mixing and converting frequency are considered. A physical explanation and quantitative evaluation are given for the dependence of the conversion factor on the frequency of the converted signal and the operating mode of a dc transistor. The reasons for reducing the conversion factor are explained. Transl. by H.W.

N70-17484# Akademiya Nauk URSR, Kiev. Inst. Matematiki.
CALCULATING THE ELECTROMAGNETIC FIELD IN MAGNETOSTRICTIVE TRANSFORMER CONVERTERS
A. A. Berezovskiy and G. I. Bondarenko *In its* Electromagnetic Processes in Converting Devices 1967 p 45–49 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

A mathematical description is given for the electromagnetic processes which occur in magnetostrictive transformer converters. Expressions are derived for calculating the electromagnetic field in these converters in the case of different elastic stresses. Transl. by H.W.

N70-17487# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE PARALLEL OPERATION OF TRANSISTORS IN SEMICONDUCTOR dc VOLTAGE CONVERTERS
Yu. I. Drabovich and V. S. Masloboyshchikov *In its* Electromagnetic Processes in Converting Devices 1967 p 73–82 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The current distribution and dissipated power of transistors are considered in circuits where they are connected in parallel. A comparison of these circuits is given. The expediency of parallel connection is proved for transistors in dc voltage converters. Transl. by H.W.

N70-17488# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
SYMMETRIZATION OF A SINGLE-PHASE LOAD CONNECTED INTO A STAR WITH BALANCING ELEMENTS
A. K. Shidlovskiy *In its* Electromagnetic Processes in Converting Devices 1967 p 83–88 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

A case is considered for symmetrizing a three-phase circuit under a single-phase load when the load and balancing elements are connected into a star. The possibilities of balancing the circuit are analyzed by the method of coincidence diagrams. Transl. by H.W.

N70-17490# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE EFFECT OF CHOKE COIL Q-FACTORS ON THE PARAMETERS OF BALANCING DEVICES
A. D. Muzychenko *In its* Electromagnetic Processes in Converting Devices 1967 p 96–105 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

Application of the method of coincidence diagrams is described for analyzing the effect of active choke coil resistances on the parameters of balancing devices. Equations are derived for designing two- and three-element circuits with consideration of the Q-factor of the choke coils employed. Transl. by R.B.

N70-17491# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
A SCHEME FOR CONVERTING SINGLE-PHASE INTO TWO-PHASE CURRENT
L. A. Zhuravleva *In its* Electromagnetic Processes in Converting Devices 1967 p 106–111 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The scheme is based on a phase rectifier and includes reactive resistors as auxiliary elements. The use of the irreversible properties of electrical circuits ensures symmetry of voltages and currents in the load at the output. Transl. by H.W.

N70-17492# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
AN ALTERNATING CURRENT MAGNETIC SEMICONDUCTOR CHOKE COIL SWITCH
V. Ye. Tonkal, I. V. Volkov, L. P. Melnichuk, and K. A. Lipkovskiy *In its* Electromagnetic Processes in Converting Devices 1967 p 112–120 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

Theoretical and experimental analysis is carried out for various circuit solutions. The applications of such a device include the conversion of frequency from 0 to 7 kHz and its use as frequency dividers and multipliers, modulators, or non-contact relays. Transl. by H.W.

N70-17493# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE ELECTROMAGNETIC PROCESSES IN AN ALTERNATING CURRENT MAGNETIC SEMICONDUCTOR SWITCH
L. P. Melnichuk *In its* Electromagnetic Processes in Converting Devices 1967 p 121–128 ref In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The electromagnetic processes are investigated in a magnetic semiconductor switch in the case of the short-circuiting or disconnection of the secondary winding of the transformer, the primary winding of which is connected in series with the load resistance. Transl. by H.W.

N70-17494# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE MAXIMUM EFFICIENCY OF PUSH-PULL CIRCUITS IN MAGNETIC AMPLIFIERS
I. V. Volkov, L. N. Bykov, and V. Ye. Tonkal *In its* Electromagnetic Processes in Converting Devices 1967 p 129–133 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

It is shown that the efficiency of push-pull magnetic amplifiers with direct current output cannot exceed 50 percent. The efficiency can be increased over 50 percent by using various nonlinear resistors. Transl. by H.W.

N70-17495# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE TRANSIENT PROCESSES IN A DIRECT CURRENT REVERSIBLE BRIDGE DURING OPERATION ON AN ACTIVELY INDUCTIVE LOAD
L. N. Bykov and L. L. Pavlov *In its* Electromagnetic Processes in Converting Devices 1967 p 134–139 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The transient processes are considered when a reversible bridge is switched on and off. Conclusions are made concerning the various time constants during switching of a reversible bridge. Transl. by H.W.

N70-17496# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
SELECTING THE CIRCUIT FOR THE CONTROL MECHANISM OF A COMPENSATION-TYPE VOLTAGE STABILIZER
B. Ye. Kubyshin and G. A. Mikhalevich *In its* Electromagnetic Processes in Converting Devices 1967 p 140–145 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

Double and triple circuit systems of magnetic biased booster regulators are considered. Graph functions are given which permit judgments on the application of the circuits and the rational selection of their parameters. Transl. by H.W.

N70-17497# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
CHARACTERISTIC OPERATING FEATURES OF A COMPENSATED MAGNETIC AMPLIFIER IN RELAY MODE
K. A. Lipkovskiy *In its* Electromagnetic Processes in Converting Devices 1967 p 146–149 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The relay characteristics are studied for a magnetic amplifier with no-load current compensation. It is shown that a non-contact relay based on a compensated magnetic amplifier can operate as a repeater, flip-flop, and invertor, the transition from one mode to another occurring due to the variation in the depth of feedback.
Transl. by H.W.

N70-17498# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
ONE TYPE OF FEEDBACK
B. V. Bolotov and O. V. Babak *In its* Electromagnetic Processes in Converting Devices 1967 p 150–154 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

It is shown that by a certain change in design it is possible to construct a magnetic amplifier with a reverse internal feedback using two cores connected by a jumper. The presence of the current-carrying jumpers substantially alters the nature of the phenomena in the region of negative feedback and causes a significant increase in the amplification factor. Transl. by H.W.

N70-17499# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE STRUCTURE OF THE LINE DIAGRAMS OF MAGNETIC BIASED REGULATORS
B. Ye. Kubyshin and G. A. Mikhalevich *In its* Electromagnetic Processes in Converting Devices 1967 p 155–158 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The problems of the structure of line diagrams are considered for the power units of magnetic biased regulators. Topological concepts of electrical circuits are applied to synthesis of the internal configuration of the regulator circuits and the concept of tensor impedance is applied for indicating this structure. Transl. by H.W.

N70-17500# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE PRINCIPLES OF CONSTRUCTING CONVERTER CIRCUITS WITH RECTANGULAR EXTERNAL CHARACTERISTICS
V. I. Reshetnyak *In its* Electromagnetic Processes in Converting Devices 1967 p 159–165 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

Based on analysis of the operation of a quadrupole, it is shown that there are four variants available for constructing converter circuits with rectangular external characteristics. Two circuits are based on the use of supplementary resistors and two on the use of Bushero circuits. An element with nonlinearity at one point is required.
Transl. by H.W.

N70-17501# Akademiya Nauk URSR, Kiev. Inst. Elektrosvarki.
TRANSIENT PROCESSES IN BRIDGE CIRCUITS WITH FULL-WAVE RECTIFICATION DURING CHARGING OF CAPACITOR BANKS THROUGH CAPACITIVE CURRENT-LIMITING ELEMENT
I. V. Pentegov *In its* Electromagnetic Processes in Converting Devices 1967 p 166–173 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The charging circuit is studied in which a current-limiting capacitor is connected to the alternating current side of a rectifier assembled in a bridge circuit. Equations are derived for the voltage in the capacitors, the charging current, and the charging time.
Transl. by H.W.

N70-17502# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
VOLTAGE STABILIZATION USING PARAMETRIC DEVICES OPERATING ON A BATTERY LOAD
V. I. Reshetnayk *In its* Electromagnetic Processes in Converting Devices 1967 p 174–176 ref In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

It is shown that the parametric devices do not produce high accuracy of voltage stabilization in the batteries. To ensure high accuracy it is necessary to use the compensation method of stabilization.
Transl. by H.W.

N70-17503# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
DESIGNING A MAGNETIC AMPLIFIER WITH AN ANALOG STORAGE
B. V. Bolotov and O. V. Babak *In its* Electromagnetic Processes in Converting Devices 1967 p 177–180 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The operation of storage devices with hard to magnetize cores is considered for the case of pulsed control. It is shown that the magnitude of the driving power is a direct function of the pulse duty factor.
Transl. by H.W.

N70-17504# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
USING THE GRAPH ANALYSIS METHOD TO DESIGN INPUT CIRCUITS OF POWER SWITCHING TRANSISTORS
V. S. Masloboyshchikov *In its* Electromagnetic Processes in Converting Devices 1967 p 181–185 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The problems of designing input circuits of transistors operating in switching modes are discussed. To switch heavy duty circuits preference is given to parallel connection of the cut-off and trigger voltages. The design of such circuits suggests using the graph analysis method which is distinguished by high clarity.
Transl. by H.W.

N70-17505# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
COMPARISON OF TRANSISTOR SWITCHING CIRCUITS IN THE SATURATION STATE
Yu. I. Drabovich *In its* Electromagnetic Processes in Converting Devices 1967 p 186–192 ref In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

Methods are given for calculating the operating modes of the transistor, which permit determination of all its parameters and characteristics in the saturation range. An analysis and comparison are conducted for transistor switching circuits.
Transl. by H.W.

N70-17506# Kiev Computer and Control Machine Plant (USSR).
A MODULATOR USING MAGNETIC ELEMENTS
V. Ye. Filippov *In* Akad. Nauk URSR Electromagnetic Processes in Converting Devices 1967 p 193–197 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

A magnetic modulator, assembled according to a bridge circuit, and with an output on the lowest frequency is considered. An analysis is given for the effect of active resistances on the stability of the zero level and sensitivity of the converter.
Transl. by H.W.

N70-17507# Akademiya Nauk URSR, Kiev. Inst. Kibernetiki.
A NONLINEAR VOLTAGE CONVERTER
S. R. Raykhman *In its* Electromagnetic Processes in Converting Devices 1967 p 198–202 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

A standard nonlinear ac voltage converter is considered for experimental operation in a system for optimizing combustion in a boiler unit. Partial linear approximation is used to derive the given ac function, and as a result, the converter does not have the deficiencies inherent in nonlinear dc converters. Transl. by R.B.

N70-17531*# Illinois Univ., Urbana.
HIGH-VOLTAGE BREAKDOWN
E. M. Lyman, R. Allen, D. Alpert, T. C. Casale, S. Y. Ettinger et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 114–122 refs (See N70-17526 06-34)
Avail: CFSTI CSCL 09A

The nature of the cathode protrusions responsible for initiation of electrical breakdown in ultrahigh vacuum was studied using the scanning electron microscope. These protrusions appear to be fingers of metal extending from the edges or interiors of small craters. The craters are produced when clumps of charged material, as yet unidentified, impinge on the surface of the cathode (or the anode), melting the local region. Using drastic cleaning procedures, the clumps, under laboratory conditions, appear to be eliminated, thus eliminating the protrusions and permitting the electrode voltage to be raised one to two orders of magnitude higher, without field emission or electrical breakdown, than was previously practical. In several cases, 60 kV was sustained between tungsten electrodes spaced 0.04mm apart, indicating a field of about 15×10 to the eighth power V/m at the electrode surface. Author

N70-17619# Signals Research and Development Establishment, Christchurch (England).
AN RF SPUTTERING SYSTEM FOR USE IN MICROCIRCUIT FABRICATION
I. G. Carver and B. J. Franklin Mar. 1969 21 p refs
(SRDE-69018) Avail: CFSTI

A simple diode RF sputtering system is described which was used to sputter amorphous quartz for thin film capacitors. The problem of feeding RF power to the gas discharge in the sputtering chamber, and some factors affecting chamber impedance are discussed. Deposition rates of quartz up to 150 pm/s were achieved, and the distribution of deposit is shown to be determined mainly by current density variation across the axis of the discharge. Author (ESRO)

N70-17922 Southern Methodist Univ., Dallas, Tex.
CIRCULAR ARC ARRAY ANALYSIS AND OPTIMIZATION
Dale Eldon Biswell (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-5517

A theoretical treatment of the analysis and optimization of circular arc arrays for applications in phased array antenna systems is presented. The analysis method utilizes the Poisson sum formula to analyze the pattern function of arrays of isotropic and short dipole elements. The directive gain and beam efficiency of circular arc arrays are expressed as the ratio of Hermitian forms. Techniques for optimizing ratios of this type are employed to obtain orthogonal sets of vectors representing the current excitations for a given distribution of the antenna elements. When the array beam efficiency is optimized, the orthogonal set of vectors obtained can be used in the synthesis of radiation pattern functions. Array thinning and amplitude tapering techniques for achieving practical sidelobe levels are studied by calculating various patterns on the digital computer. Experimental patterns are given which verify the computer analysis and the prediction of additional grating beams in certain patterns. Dissert. Abstr.

N70-17987# Army Foreign Science and Technology Center, Washington, D.C.
THE AXISYMMETRIC EXCITATION OF A CYLINDER HAVING VARIABLE SURFACE IMPEDANCE
G. D. Malushkov 23 Oct. 1969 26 p refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii, Radiofiz. (Gorki), v. 11, no. 9, Sep. 1968 p 1410–1422
(AD-697075; FSTC-HT-23-010-70) Avail: CFSTI CSCL 9/5

The problem of the axisymmetric excitation of a finite cylinder with variable surface impedance along the generating line is solved by the method of integral equations of the first kind with different variation regions of the observation and integration points. The cylinder is excited by a transverse circular slot with zero variation along the azimuthal coordinate of the external electric field intensity. The procedure for obtaining the integral equation and the method of solving it are shown, and design formulas are given. The results of current distribution calculations on a cylinder with an inductive reactance band are shown with linearly varying inductive reactance as well as with changing square-law active impedance. The radiation patterns are shown for linearly increasing and linearly decreasing impedance change laws. Author (TAB)

N70-18013# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
DEVELOPMENT AND INVESTIGATION OF A LINEAR FUNCTIONAL MULTIPLIER ON THE BASE OF HALL SENSORS
S. Sukhanov et al Apr. 1969 10 p refs Transl. into ENGLISH from Akad. Nauk Turkmenskoy SSR, Izv. Ser. Fiz Nauk (USSR), no. 2, 1967 p 23–28 Sponsored by MIT, Lincoln Lab.
(Rept-164-69-374-Rull) Avail: CFSTI

Described is a linear multiplier using thin crystal Hall sensors made from either doped InSb, InAs, or GaAs and a magnetic circuit made from ferrite materials. Measurements on the basic characteristics of the multiplier carried out in a constant current showed that: (1) the value of the output signal varies as a function of the level of the multiplying signals and temperature range; (2) the temperature range expands as a function of magnetic and semiconductor materials from 223 to 343 degrees K for doped InSb and InAs, and up to 223 to 473 degrees K for GaAs; and (3) volume and weight of the multiplier are determined by the geometries of the Hall sensor and the required output level of the multiplier. G.G.

N70-18029 Oregon State Univ., Corvallis.
VACUUM EVAPORATED DIELECTRICS IN MOS STRUCTURES
Dennis Richard Delzer (Ph.D. Thesis) 1969 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-5826

Dielectric films were deposited on substrates by electron bombardment evaporation of sapphire and quartz source materials. These deposited films were studied using infrared spectroscopy, index of refraction, density, and dielectric constant measurements. Etching tests were also conducted on the dielectric films. Annealing these films was also tried. From the results of these tests, it was concluded that suitable aluminum oxide and silicon dioxide films can be obtained by e-Gun evaporation. The best results were obtained for slowly evaporated films on substrates heated above 200 C. Better films were obtained after annealing for ten minutes at 1100 C in dry nitrogen. The diffusion masking properties of the e-Gun evaporated silicon dioxide and aluminum oxide films were studied. The evaporated films were tested for the masking of phosphorous and boron diffusion into silicon, of gallium and indium diffusion into germanium, and of zinc diffusion into gallium arsenide. Dissert. Abstr.

N70-18060# Joint Publications Research Service, Washington, D.C.
ROTARY INDUCTOSYN: GENERAL INFORMATION AND ERROR THEORY
Donat Alekseyevich Bychatin et al 24 Dec. 1969 31 p Transl. into ENGLISH from Povorotnyy Induktosin (Leningrad), 23 Apr. 1969 p 3–37
(JPRS-49509) Avail: CFSTI

The theoretical and practical bases for the design and manufacture of inductosins are examined. The principles of operation

of the synchro transmitter are considered and an error analysis is made. The engineering problems involved in designing, manufacturing, and testing the transmitter are discussed. The inductosin is designed for programmed control of metal-cutting lathes, radar instruments, navigational systems, and other areas where accurate measurement of angular motion is required. R.B.

N70-18064# Ohio State Univ., Columbus. Electroscience Lab.
A TWO-DIMENSIONAL RAY-TRACING METHOD FOR THE CALCULATION OF RADOME BORESIGHT ERROR AND ANTENNA PATTERN DISTORTION Technical Report
N. R. Kilcoyne 2 Oct. 1969 124 p refs
(Contract N00019-69-C-0325)
(AD-696163) Avail: CFSTI CSCL 9/5

A two-dimensional ray tracing analysis for the calculation of radome boresight error and antenna pattern distortion is presented. Emphasis was placed on the development of a method having considerable flexibility, so as to enable application of the method to a wide range of antenna-radome problems, and on relative ease of calculations, so as to minimize calculation time. Several example problems were calculated to demonstrate the usefulness of the approach. Comparisons between calculations and measurements were included whenever measured data were available. Instructions for use of this completely computerized method are included along with several tables describing variables and the complete computer program with necessary subroutines. Programs were written in Fortran IV language suitable for use on the OSU version of the IBM system 360/75 (some minor changes may be required for use on other 360/75 installations). Author (TAB)

N70-18102# Airborne Instruments Lab., Deer Park, N.Y.
DEVELOPMENT AND TEST OF VARIABLE-APERTURE WAVEGUIDE ANTENNA ARRAY FOR GLIDE-SLOPE SYSTEM Final Report
Girt C. Kundzins Jul. 1969 86 p
(Contract FA-65-WA-1368)
(FAA-RD-69-51) Avail: CFSTI

This report describes a development and flight-test program of a directional variable-aperture wave guide glide-slope system that is fully compatible with ICAO ILS standards and conventional airborne receivers, but that does not rely upon the ground reflected signals required by conventional glide-slope systems. The operation of an aperture-field monitor for the wave guide array is also described. Author

N70-18116 Auburn Univ., Ala.
DIELECTRIC BREAKDOWN IN THIN FILMS OF ALKALI AND ALKALINE-EARTH FLUORIDES
James Lynn Smith (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-5513

An experimental study is described for electric breakdown in thin evaporated Al-dielectric-Al capacitors, where the dielectrics are CaF2, MgF2, NaF and LiF. The dielectric thicknesses cover the range 700–30,000 Å. The purpose of this study is to evaluate existing electronic breakdown theories for ionic crystals, and point out necessary modifications. Prebreakdown dc current-voltage-temperature and ac impedance-temperature data are obtained. The voltage thresholds for both the onset and cessation of breakdown are studied as functions of temperature, thickness and voltage rise rate at different temperatures. The temperature range is generally 80–380°K. Optical micrographs of breakdown sites and voltage waveforms during breakdown are also obtained. No systematic correlations between prebreakdown voltage-current-temperature data and breakdown characteristics are found. Dissert. Abstr.

N70-18136# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN OF DIGITAL CONTROL SYSTEMS
V. P. Petrov 23 May 1969 110 p Transl. into ENGLISH from the book "Proyektorovaniye Tsifrovykh Sistem Kontrolya i Upravleniya" Moscow, Mashgiz, 1967 p 218–267, 150–157, 169–200
(AD-693280; FTD-MT-24-108-69) Avail: CFSTI CSCL 9/3

The book deals with problems of designing equipment for automatic control systems consisting of decentralized objects. Functional-assembly methods of designing various-purpose electronic equipment through the use of standard high-reliability electronic elements are described. A number of standard elements and structures are recommended for wide application in the development of digital computer devices, equipment, units of industrial automation, computing technique, control, communication, and signaling. Methods for the optimization minimization of switching circuits are discussed. A multi-purpose telemetric-computing system, suitable for industrial production, dispatching, automatic control of irrigation installations, oil wells, water and gas distribution systems, etc., is described. Also discussed are engineering calculations for reliability and noise immunity of data transmission systems and technical and economic efficiency in the designing of electronic equipment for automatic control systems. Author

N70-18152# Army Foreign Science and Technology Center, Washington, D.C.
MAXIMUM GAIN OF SPHERICAL AND CONICAL ANTENNAS
L. I. Ponomarev 21 Oct. 1969 24 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (USSR), v. 11, no. 5, 1968
(AD-696453; FSTC-HT-23-716-69) Avail: CFSTI CSCL 9/5

The optimization of the gain function of spherical and conical antennas consisting of a system of slotted radiating elements is solved by means of singular vector functions. Spherical antenna Q dependence on sphere elector radius is investigated and the maximum gain of spherical antennas is compared to the maximum gain of an equivalent co-phased aperture. Author (TAB)

N70-18153# Army Foreign Science and Technology Center, Washington, D.C.
INVESTIGATION OF A FREQUENCY-SCANNING ARRAY OF RADIATING ELEMENTS DEPLOYED ON A CONVEX CURVE
R. A. Granovskaya 20 Oct. 1969 16 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (USSR), v. 11, no. 5, 1968 p 452–459
(AD-696451; FSTC-HT-23-672-69) Avail: CFSTI CSCL 9/5

The problems of deploying a convex waveguide slotted array of radiating elements with frequency scanning are discussed. The experimental results of an investigation of a convex array of radiating elements are shown. A convex array of radiating elements can be replaced by a system of linear arrays of radiating elements under the conditions described. Author (TAB)

N70-18180 Arizona State Univ., Tempe.
COMBINATIONAL CIRCUIT ANALYSIS AND SYNTHESIS OF TOTAL SYMMETRIC FUNCTIONS WITH NAND OR NOR DEVICES
Earl Reding Robbins (Ph.D. Thesis) 1969 216 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-5717

A method to be called AND cover-key is used to analyze combinational NAND circuits, where a circuit transformation is used and then an AND-inhibit concept applied such that the boolean function at every gate device is determined. The cover-key method permits a profile study to be made of a circuit, in which the source gate or gates for each output canonical P term is determined and then redundant lines and gates can be found and removed from the circuit. The dual of the AND cover-key method is the OR cover-key method which is used to analyze NOR circuits. Mixed NAND, NOR circuits can be analyzed by a combination of the two methods. A second research topic pertains to the detection of total symmetric boolean function with a mixed variable of symmetry. A

new method is given in which each canonical P term has a unique potential value and the sum of the potential values determines the potential value of the variable of symmetry. Dissert. Abstr.

N70-18185# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
NEW WIDE-BAND FERRITE DIRECTIONAL LINES WITH COMB-LIKE BRANCH STRUCTURES
Walter Nowak Jun. 1969 30 p refs Transl. into ENGLISH from Hochfrequenztechnik und Elektroakustik, (Germany), v. 72, no. 4, 1963 p 138–146 Sponsored by MIT
(Rept-(136)-69-263-GELL) Avail: CFSTI

The electromagnetic field distribution in a triplet line is investigated when the middle conductor is provided with short branch lines arranged as a comb. It is shown that points with circular polarization of the magnetic field appear over very large bandwidths. The polarization of the external magnetic field, necessary for a maximal front to back damping ratio as a function of the ferrite cross section form is calculated with the disturbance theory. It is shown that the described structures can be connected by means of abrupt transition to normal Lecher transmission lines without spattering. This is considered to offer the possibility of manufacturing printed circuits without the use of special dielectrics. F.O.S.

N70-18192 Michigan State Univ., East Lansing.
IMPEDANCE-LOADED RECEIVING ANTENNAS WITH MINIMUM BACKSCATTERING AND MAXIMUM RECEIVED POWER
Howard Joseph Deck (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-5855

A reduction in the amount of electromagnetic power backscattered from a dipole receiving antenna, utilizing techniques of impedance loading is achieved by inserting lumped impedances directly into the antenna itself in an effort to modify the distribution of induced current on the antenna. With two identical auxiliary impedances placed symmetrically about the center-load impedance, an approximate closed-form solution is found for the antenna current distribution. The condition of zero broadside backscattering is established in the form of a constraint equation between the auxiliary impedances and the center-load impedance. A very interesting phenomenon occurs at a specific position of the auxiliary load. At one particular frequency, with the value and placement of the auxiliary reactance properly selected, the resulting antenna is not only invisible to electromagnetic illumination at normal incidence, but is incapable of delivering any power to the center impedance. Dissert. Abstr.

N70-18194# Royal Aircraft Establishment, Farnborough (England).
LOGIC BOARD TEST SET
W. Taylor Feb. 1968 15 p
(RAE-TM-WE-1267) Avail: CFSTI

A test set for checking plug-in logic boards or subassemblies for correct functioning before they are offered up to the main system is described. The design allows boards with up to 29 connections to be tested. With the use of a 30 × 20 cross-bar switch any permutation of the 29 connections can be accommodated. Author

N70-18224# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
DESIGN OF INTEGRATED CIRCUITS WITH THE USE OF DIGITAL COMPUTERS
V. V. Petukhov and O. S. Poturayev Apr. 1969 24 p refs Transl. into ENGLISH from Izvest. Vuzov. SSSR. Radioelektronika (USSR), v. 11, no. 7, 1968 p 719–729 Sponsored by MIT
(Rept-(156)-69-312-RULL) Avail: CFSTI

A brief review is given of the two most important problems which are encountered in designing integrated circuits (IC) with the use of digital computers - modeling IC's and designing the optimum topology of the circuits, including large-scale integrated circuits. The basic particular problems in the design of IC's and methods of solving them (algorithms) are examined. Evaluations of the present level in solving these problems on digital computers and the prospects of their development are given. Author

N70-18271*# ITT Electron Tube Div., Fort Wayne, Ind.
RESEARCH AND DEVELOPMENT OF A SINGLE GUN COLOR CRT, PHASE 2 Final Report
Thomas E. Sisneros, Paul A. Faeth, and Joseph A. Davis
Washington NASA Jan. 1970 58 p ref
(Contract NAS12-534)
(NASA-CR-1514) Avail: CFSTI CSCL 09A

The more important phosphor synthesis parameters were investigated for factors responsible for superlinear and sublinear cathodo luminescence. Phosphors with pronounced superlinear and sublinear character were synthesized, and the better phosphors employed in the fabrication of 5 inch cathode ray tubes. Color gamuts covering the range of colors from greenish-yellow to orange-red were obtained with beam current densities of 0.05 to 10 micron a/sq cm. Relative brightness of the final quarterly tube, Q-2, ranged from 0.9 ft lamberts at 0.05 micron a/sq cm beam current density to 400 ft lamberts at 10.0 micron a/sq cm and 15 kv beam voltage. Author

N70-18285# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF INDUCTION DEVICES FOR DETECTING UNDERGROUND COMMUNICATIONS
V. F. Bakhmutskiy 23 Jan. 1970 13 p refs Transl. into ENGLISH from Otbor i Peredacha Inform. (Kiev), no. 17, 1968 p 110–121
(JPRS-49683) Avail: CFSTI

An induction device is considered to be a fixed system of exciting and receiving loops moving along profiles being investigated above the daytime surface. The primary signal induced by the exciting loops in the receiving loops is suppressed by means of the usual methods of geometric and electric compensation. The optimum designs of devices are investigated which are immune to interference and which do not have large errors in determination of the route and depth of cable or pipeline embedment. R.B.

N70-18290# Joint Publications Research Service, Washington, D.C.
FERRITE CIRCULATORS
B. Patchezerov 19 Jan. 1970 7 p refs Transl. into ENGLISH from Tekhn. i Vooruzheniye (USSR), no. 11, Nov. 1969 p 30–31
(JPRS-49712) Avail: CFSTI

An experimental three branch ferrite circulator for reception and amplification of very weak electromagnetic signals was designed. The circulator is described as a waveguide or coaxial fork having three or more outputs. Diagrams showing the structure and the flow of the magnetic field of the circulator are given. The importance of the combined magnetic and electrical parameters of ferrite is emphasized. J.M.C.

N70-18296# Joint Publications Research Service, Washington, D.C.
LOW-POWER MICROWAVE ELECTRON GENERATORS
M. B. Golant 8 Jan. 1970 16 p refs Transl. into ENGLISH from Izv. Vuzov SSSR Radioelec., (RUSSIAN), v. 12, no. 9, 1969 p 950–961
(JPRS-49569) Avail: CFSTI

A brief description of the state of the art and prospects for development of low-power microwave electron generators is presented. The state of development of this class of instruments is characterized by the achievement of an electronic tuning range of up to several octaves, an efficiency reaching tens of percentages, long-term stability reaching 10 to the 10th power, the lowest noise

of all microwave generators including quantum generators, and mastery of the wave range up to 0.2 mm. The basic problematics of this class of devices are analyzed. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-17361*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

ON THE DESIGN OF A DIGITAL COMPUTER PROGRAM FOR THE DESIGN OF FEEDBACK COMPENSATORS IN TRANSFER FUNCTION FORM

Michael Athans Dec. 1969 24 p refs

(Grants NGL-22-009-124; AF-AFOSR-1724-69; NSF GK-14152; MIT Proj. DSR 71526; MIT Proj. DSR 76265; MIT Proj. DSR 72013)

(NASA-CR-107859; ESL-R-409) Avail: CFSTI CSCL 09C

The purpose of this report is to indicate, in an informal manner, the possibility of constructing a digital computer program which can compute automatically the transfer function of a feedback compensator given the transfer function of the open loop plant and the statistical properties of any disturbance and/or measurement noise. The internal computations are based on the solution of the linear stochastic optimal control problem in state variable format. However, the answer is computed in the frequency domain because the feedback compensator is described in a partial fraction (Heavyside) expansion of the transfer function. Author

N70-17442*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.

ELECTRODE MATERIAL RELEASE DURING HIGH VOLTAGE BREAKDOWN Final Technical Report

Richard T. Schneider, Tristram B. McCall, III, and Guenther H. Lohnert Jan. 1969 118 p refs

(Grant NGR-10-005-054)

(NASA-CR-107880) Avail: CFSTI CSCL 09C

Electrode erosion is studied as a high voltage breakdown mechanism in a vacuum by measuring the amount of material released during the breakdown, and by analyzing the fate of this material during the discharge time. The breakdown is believed to be caused by electron beams accelerated by the field between the electrodes. These electron beams result from surface imperfections (whiskers) being vaporized by field emission current heating. It is concluded that: (1) The released electrode material forms a highly ionized plasma which is the medium providing the current transport. (2) There is a threshold energy required for material release. (3) Material is released from both electrodes. (4) The resistivity voltage drop at the breakdown gap is on the order of 2000 V. F.O.S.

N70-17489# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.

THE SYMMETRICAL DISTRIBUTION OF A SINGLE-PHASE LOAD BETWEEN THE PHASES OF THE POWER NETWORK WITHOUT DISTORTION OF THE POWER FACTOR

A. K. Shidlovskiy and A. D. Muzychenko *In its* Electromagnetic Processes in Converting Devices 1967 p 89–95 refs In RUSSIAN (See N70-17478 06-09)

Avail: CFSTI

The problems of calculating the parameters of balancing devices are discussed in the case of the equality of power factors at the input and output. The method of coincidence diagrams is used for calculation. Transl. by H.W.

N70-17538*# Illinois Univ., Urbana.

NETWORKS

T. V. Trick, W. Mayeda, M. E. Mokari-Bolhassan, S. Toida, J. Vlach et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 259–269 (See N70-17526 06-34)

(Grant AF-AFOSR-931-67)

Avail: CFSTI CSCL 09C

A computer optimization method is reported for the broad band matching of complex generator and load impedances to a lumped distributed network. The network may contain active elements such as transistors. The study of system diagnosis from the topological point of view is in progress. In addition some results from the study of the characterization of biplanar graphs are given. Author

N70-17539*# Illinois Univ., Urbana.

CONTROL SYSTEMS

J. B. Cruz, Jr., C. I. Chen, G. D'Ans, J. Davis, J. E. Heller et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 270–291 refs (See N70-17526 06-34)

(Grants AF-AFOSR-1579-68; NSF GK-3893)

Avail: CFSTI CSCL 09C

Intensive investigations of computationally feasible methods of design of large scale systems is underway. Furthermore, additional results concerning minimax algorithms and feedback strategies for differential games were obtained. Finally, suboptimal filtering, sensitivity of distributed parameter systems, adaptive systems, and applications of optimal control theory to traffic control and rolling mill design are being investigated. Author

N70-17540*# Illinois Univ., Urbana.

SWITCHING SYSTEMS

G. Metze, H. Finkelstein, T. Gaddess, J. Hayes, M. Paige et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 292–295 refs (See N70-17526 06-34)

(Grant NSF GK-1663)

Avail: CFSTI CSCL 09C

The investigation of fault diagnosis methods for digital systems was continued. Results were obtained on the improvement of diagnosability by test point insertion, on the detection of multiple faults by single fault tests, and on the generation of diagnostic tests for networks of modules. Work continues on methods of synthesizing sequential networks which are optimal from the diagnosis viewpoint and on fault diagnostic properties of regular arrays. Author

N70-17756 Maryland Univ., College Park.

LIMIT CYCLE FREQUENCY STABILIZATION IN A BISTABLE CONTROL SYSTEM

Richard Lawrence Martin (Ph.D. Thesis) 1968 114 p refs

Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-7201

A limit cycling control system is described. The gain of the nonlinear element to the limit cycle and a low frequency input signal is reviewed, and the dynamic response of the limit cycle amplitude is presented. A technique for stabilizing oscillators by the addition of a stable reference signal is applied to the limit cycling system. The dynamics of the locking process and the resulting effects on the system stability are analyzed. Procedures are presented to determine the steady state phase between the limit cycle and the reference signals and the change in system gain for a given system, whether single mode or dual mode. Dissert. Abstr.

N70-17884# Centro Informazioni Studi Esperienze, Milan (Italy).

TOPICS IN COMPUTER AIDED CIRCUIT DESIGN

I. De Lotto (Bologna Univ.) *In* EURATOM Panel Discussion on Future Trends in Phys. Meas. and Nucl. Instr. Oct. 1969 p 5–10 refs Sponsored by CNR (See N70-17882 06-24)

Avail: CFSTI

The research and development needed to obtain an efficient tool for the analysis and design of circuits and devices are described.

The problems of network analysis are reviewed, emphasizing the techniques for large size circuits and systems such as large scale integration. Device modeling is discussed, and it is shown that computer aided analysis makes it feasible to use lumped, linear, finite models, and also nonlinear, distributed, nonreciprocal models. The nonlinear programming problems involved in optimal design are formidable size and complexity of programs, long execution times, lack of assurance that the program converges to the optimum, an analysis program to compute the objective function, and the choice of a suitable objective function. A new technique is mentioned for automatic network design based on Tellegen's theorem. N.E.N.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-16993# Army Electronics Command, Fort Monmouth, N.J.
DESIGN OF A CROSS-POWER SPECTRAL DENSITY ANALYSIS FACILITY
F. N. Warner and A. A. Landi Aug. 1969 36 p
(AD-697111; ECOM-3163; OSD-1366) Avail: CFSTI CSCL 14/2

Experimental efforts of the Servo Control Studies Task require the availability of a cross-power spectral density analysis facility. Data for control system equipments in field operation is recorded on magnetic tape and processed on the facility to produce spectral plots. The resultant spectral plots are utilized in experimental efforts to improve servo control system evaluation techniques. This report describes a cross-power spectral density analysis facility recently completed in an in-house development for the Servo Control Studies Task. The design of the facility described proved to be a practical means of mechanizing the equation involved in the computation of required spectral quantities. Author (TAB)

N70-17207# Goodyear Aerospace Corp., Akron, Ohio.
DEVELOPMENT OF LIGHTWEIGHT INFINITY OPTICS DISPLAY FOR FIELD EVALUATION Final Technical Report, 1 Aug. 1967 - 31 Aug. 1969
James A. Horton and John F. Bartucci Aug. 1969 66 p
(Contract F33615-67-C-1985)
(AD-696696; GER-14409; AFHRL-TR-69-13) Avail: CFSTI CSCL 14/2

A reflective optical infinity display system was designed and fabricated. Special features of the display include very large plastic mirrors and a high-brightness, high-resolution television monitor. The plastic mirrors provided a large weight reduction compared to their glass equivalents and the monitor provided the very high brightness levels that this type of display requires. Size of the overall display system was largely established by the requirement that the unit be designed to operate with a C-130E simulator. Author (TAB)

N70-17295*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.
THE SURVEYOR EXPERIMENTAL TEST LABORATORY Technical Memorandum
W. Peer 15 Jan. 1970 15 p revised
(Contract NAS7-100)
(NASA-CR-107847; JPL-TM-33-445-Rev-1) Avail: CFSTI CSCL 14B

This report covers the physical description and the various applications of the Surveyor Experimental Test Laboratory (SETL). Developed as an answer to the need for obtaining design and analytical information about the Surveyor spacecraft and its mission to the moon, SETL applications include simulation, training, instrument development, and the use and handling of mosaics. Several unique and specialized instruments and techniques for their use are covered. Hundreds of television and soil mechanics experiments gave invaluable information for the analysis of the data from the moon. The overall success of the Surveyor program points out the SETL potential for future missions. Author

N70-17358*# Boeing Co., Wichita, Kans.
A PRELIMINARY SYSTEMS STUDY OF INTERFACE EQUIPMENT FOR DIGITALLY PROGRAMMED FLIGHT SIMULATORS
Keith B. Du Lac and Everett L. Johnson Oct. 1969 47 p refs
(Contract NAS2-5524)
(NASA-CR-73407; D3-8143) Avail: CFSTI CSCL 14B

Five areas of a supersonic transport flight simulator were investigated: (1) Six techniques of direct digital drive were examined. These techniques are classified as quasi closed loop, closed loop and open loop systems. The applicability to a supersonic transport simulation and the availability of each system is given. (2) The frequency response and operation of eight SST instruments are given. Feasibility of direct digital drive for these instruments is discussed. (3) Interfacing of cockpit controls with the digital computer by means of analog to digital converters, encoders, and synchro to digital converters is discussed. (4) Supersonic transport moving base simulator data recording requirements are given. A comparison is made between analog and digital strip chart recorders for use in an all digital simulation. (5) Configuration of a project engineer's console based on moving base flight simulators. Author

N70-17644# TRI-Univ. Meson Facility, Vancouver (British Columbia).
TRI-UNIVERSITY MESON FACILITY Annual Report, 1968
J. J. Burgerjon, ed. Dec. 1968 44 p
(NP-18024) Avail: CFSTI

A sharp rise in activities following the announcement on April 16, that funds had been approved is described. Progress in the cyclotron and beam transport design has been increasing during the latter part of the year as specialist staff have joined. Special mention is made of the completion of the first TRIUMF physics experiment. With extraordinary help from the Rutherford Laboratory, using their Proton Linear Accelerator precise measurements were made of the life-time of the H (-) on under conditions which pertain to the outer orbit radius for TRIUMF. These measurements were completed most expeditiously and in time to make the necessary adjustments to the cyclotron parameters without delay to the project. Author (NSA)

N70-17653*# Connecticut Univ., Storrs. School of Engineering.
DYNAMIC ANALYSIS OF LUNAR GRAVITY SIMULATOR
C. H. Knapp Jan. 1970 15 p
(Grant NGL-07-002-002)
(NASA-CR-107882) Avail: CFSTI CSCL 14B

Dynamic modeling of the simulator cable was begun in a program aimed at controlling cable tension and carriage position of the lunar gravity simulator in such a way that the vertical and horizontal oscillations are kept satisfactorily small. Analytical expressions are derived in which the cable is approximated by a number of point masses connected by springs with each spring constrained to move along the axis separating the point masses. The result is a nonlinear system of equations for which at least two states per mass (angle and length change) can be measured. Equations of motion for the carriage, cable, and module are described. D.L.G.

N70-18081*# National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.
LARGE-AREA PROTON BEAMS ESTABLISHED AT THE

NASA SPACE RADIATION EFFECTS LABORATORY IN THE ENERGY RANGE FROM 31 TO 225 MeV
Gerald F. Hill and William C. Honaker Washington Feb. 1970 43 p refs
(NASA-TN-D-5479; L-6506) Avail: CFSTI CSCL 14B

In a series of experiments to produce large-area proton beams a total of 14 beam configurations were established. The proton beams varied in size from 11.3 cm horizontal by 9.7 cm vertical for full width at half maximum to 78 cm horizontal by 78.5 cm vertical for full width at half maximum and covered an energy range from 31 MeV to 225 MeV. Horizontal and vertical profiles of each beam configuration were determined by using a foil activation technique. Each profile was fitted by the method of least squares to a Gaussian function, with the full width at half maximum value indicated. Repeatability of beam shape and proton flux has been shown to be very good. Author

N70-18142# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SATELLITE MOVEMENT SIMULATOR
Albert Roelker 1969 5 p ref Transl. into ENGLISH from DVL Nachrichten, (Germany), Jan. 1969 p 422–423 Prepared for MIT
(AZT-69-504-GELL) Avail: CFSTI

A satellite simulator is described which consists of a round platform having triaxial freedom as the platform can rotate around three axes (longitudinal, tranverse and vertical axis) and floats on a spherical air cushion. The platform is controlled by six compressed air jets arranged vertically to one another, which can be remotely activated by hand or computer, or by aggragate on the platform. It is concluded that the simulator can be operated both for the investigation of spin-stabilized as well as triaxial-stabilized satellites, and at the same time nutation control, fuel optimization and time optimization can be studied. F.O.S.

N70-18200# Finnish Meteorological Office, Helsinki.
ON THE MEASUREMENT OF RVR AT HELSINKI AIRPORT
J. Riissanen and T. Lumme 1969 18 p refs *Its* Contrib. No. 73
Avail: CFSTI

The possibility of automatic measurement of runway visual range (RVR) is being studied at Helsinki airport. For this purpose special instrumentation consisting of a transmissiometer, analog-digital computer and background brightness measuring device has been installed there. This instrumentation continuously measures the atmospheric transmittance and background brightness, computes the visibility on the runway according to Allard's law and continuously presents this visibility in digital form. This instrumentation has been in experimental use since March 1968. During 1968 a comparison with visual observations was made. This verification shows the mean differences between the observed and measured RVR. The observed error shows a tendency to increase when RVR decreases below about 550 m. This error or at least a greater part of it seems to be caused by the runway light intensity distribution which was used in the computer part of the instrumentation. The light intensities of runway lamps, especially of those at the beginning of the runway, are shown to be markedly lower than those used in the computer. Author

N70-18242*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXTERNAL PROTON BEAM CHARACTERISTICS OF THE NASA SPACE RADIATION EFFECTS LABORATORY SYNCHROCYCLOTRON
Gerald F. Hill, William C. Honaker, and Fred F. Hubble III (Florida State Univ.) Washington Feb. 1970 80 p refs
(NASA-TN-D-5482; L-6482) Avail: CFSTI CSCL 14B

The proton beam transport system for the 600 MeV synchrocyclotron at the NASA space radiation effects laboratory was set up to deliver a series of proton beams covering an energy range of 40 MeV to 595 MeV. The energies of these beams were measured at 10 points with a range-energy spectrometer and found to be 595, 480, 380, 325, 225, 155, 95, 75, 50, and 40 MeV. An energy spread of + or -4.9 MeV was found for the high energy (595-MeV) primary beam extraction system and + or -1.13 MeV for the low energy (325-MeV) primary beam extraction system. Proton beam intensities of the 595 MeV and 325 MeV beams were measured and found to be 5.3×10 to the 10th power and 3.0×10 to the 10th power protons/sec, respectively. Relative beam intensity profiles were determined for each beam configuration. Appropriate magnet settings, copper degrader thicknesses, main magnet current, and other relevant data are presented for each beam configuration. Author

N70-18301# Specola Vaticana (Vatican City).
THE VATICAN OBSERVATORY
P. J. Treanor Mar. 1969 48 p refs
Avail: CFSTI

Observatory equipment used in research on the structure of the Galaxy and stellar evolution is described. Equipment includes a 63/98 cm Schmidt telescope, which is provided with three large objective prisms for the study of stellar spectra, and a 80 cm Cassegrain reflecting telescope; a 40 cm aperture quadruplet photographic camera; a visual refractor of 40 cm aperture; and a Carte du Ciel 33 cm refractor. Also briefly described are the computing center with an IBM 1620 computer and other data processing equipment, an astronomical library, and a museum containing about 460 meteorite specimens. E.C.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-16921 National Lending Library for Science and Technology, Boston Spa (England).
OBSERVATIONS ON THE USE OF RADIOACTIVE ELEMENTS IN GAS FLOW MEASUREMENTS
G. Courtois et al 30 Jul. 1969 16 p refs Transl. into ENGLISH from Bull. d'Inform. ATEN (French), no. 63, Jan.–Feb. 1967 p 6–12
(NLL-CE-Trans-4957-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Examines the possibilities of using two radioactive methods of gas flow measurements. Intermittent methods using radioactive tracers: dilution, integration and two peak are considered and methods employing the ionization of radiation from sealed sources, applicable more especially to regulation and control problems are discussed and their relative merits compared. Author

N70-16923 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF TWO-DIMENSIONAL NOZZLE CASCADES OPERATING IN WET STEAM [ISSLEDOVENIE PLOSKIKH RESHETOK SOPLOVYKH LOPATOK NA VLAZHNOM PARE]
I. I. Kirillov et al 29 Aug. 1969 7 p refs Transl. into ENGLISH from Energomashinostroenie USSR (Moscow), v. 14, no. 6, 1968 p 36–37 In RUSSIAN and ENGLISH
(NLL-Trans-4325-(9022.3108)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Profile energy losses in two-dimensional cascades operating in wet steam were studied by high speed photography and by comparing total pressure measurements from inlets and outlets. Losses in superheated and wet steam cascades showed an increase both in the body of the flow and in edge wakes. This effect was attributed to the different expenditure of steam flow energy on

moisture transportation. Increased Mach numbers also increased the mean coefficient of profile losses in the main body of the flow substantially. G.G.

N70-16926 National Lending Library for Science and Technology, Boston Spa (England).
OIL PRESSURE CHARACTERISTICS
H.-J. Brosinsky 20 Aug. 1969 11 p refs Transl. into ENGLISH from MTZ (German), v. 30, no. 2, Feb. 1969 p 54 – 66
(NLL-Trans-1154-(9022.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

The recording of oil pressure characteristics and their evaluation with respect to oil reserve, state of wear of the bearings and of the oil pump, functioning of the valves, oil supply during cold starting and over the entire temperature range, and cavitational damage, was discussed and illustrated by means of examples. The oil pressure characteristics offer rapid and simple means for the early observation of numerous defects of a lubrication system on the test bench, and for avoiding them. Author

N70-16941# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
CALCULATION OF THE NORMAL-STRESS DISTRIBUTION IN A CURVED WALL JET
Richard J. Kind Aug. 1969 40 p refs
(Contract N00014-68-A-0512; Proj. Themis)
(AD-696666; TR-18) Avail: CFSTI CSCL 1/3

A method was developed for calculating the distribution of the normal stress in a curved wall jet. The method is applicable to wall jets in both still air and moving streams. The method involves the determination of the local radius of curvature of the streamlines and then integration of the equation of motion in the direction normal to the streamlines. A comparison between some calculated and experimental results shows reasonable good agreement. Author (TAB)

N70-16979# IIT Research Inst., Chicago, Ill. Dept. of Mechanical and Aerospace Engineering.
MAGNETOGASDYNAMIC BLUNT BODY FLOW
James F. Coakley and Robert W. Porter Dec. 1969 99 p refs
(Grants NSF GK-1626; NSF GK-2844)
(PDL-1-69) Avail: CFSTI

A numerical method is developed to treat the inviscid, compressible MHD blunt body problem. The body contains an onboard magnetic dipole source with both the body and source at zero angle-of-attack resulting in axially symmetric flow and magnetic field lines. The deformation of the magnetic field is neglected for aerodynamic-like flows at low magnetic Reynolds number. The MHD equations are presented and the method of characteristics is extended to MHD flows for use in a boundary fitting numerical technique. A flexible computer program was developed which integrates the unsteady equations forward in time in a direct and automatic way. Various body geometries, variable electrical conductivity, and dipole position can be handled. Emphasis was placed on the calculation of pressure and Lorentz (MHD) drag and the variation of shock shape, sonic line, stand-off distance, etc. Calculations were performed for a hemispherical blunt body with constant electrical conductivity. Author

N70-17011# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE SELECTION OF THE OPTIMAL RATE OF REACTIVITY OF A SINGLE-STAGE TURBINE
D. A. Dekhovich 24 Mar. 1969 13 p refs Transl. into ENGLISH from Izv. Vysshikh Chebn. Zavedennii, Energ., (Russian), v. 11, no. 2, 1968 p 52 – 56
(AD-696603; FTD-HT-23-875-68) Avail: CFSTI CSCL 13/7

The selection of the optimal degree of reaction of a single-stage turbine is studied based on the maximal circumferential efficiency, with the leakage losses not being taken into account. Using an Euler equation to represent work at a point on the turbine wheel circumference, a formula is obtained for the circumferential efficiency from which, after making certain assumptions and transforms and making use of equations of energy and continuity, a formula for the optimal degree of reaction is derived. Assuming that the obtained optimal value for the degree of reaction corresponds to the minimal total losses in the blade rings and to the exit velocity, then the flow angle at the exit of the rotor wheel can be other than 90 degrees. In this connection, the variations are discussed which this angle undergoes which depend on a value at the optimal degree of reaction. It is concluded that, depending on the relative circumferential velocity at the optimal degree of reaction, the angle of the flow discharging from a single-stage turbine rotor wheel can be either larger or smaller than 90 degrees. Author (TAB)

N70-17012# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
PHENOMENA SURROUNDING HIGH SPEED FLOW Final Report, 1 Dec. 1966 – 30 Nov. 1969
S. I. Pai and J. R. Dorfman Feb. 1969 16 p refs
(Grant AV-AFOSR-1015-67)
(AD-696690; AFOSR-69-2716-TR) Avail: CFSTI CSCL 20/4

This report summarizes briefly the work done on the subject of radiation gas dynamics and the kinetic theory of gases. Author (TAB)

N70-17081# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
SELF-SIMILAR STRONG SHOCKS WITH RADIATION IN A DECREASING EXPONENTIAL ATMOSPHERE
Dallas D. Laumbach and Ronald F. Probstein Jul. 1969 23 p refs Sponsored in part by ARPA
(Contract Nonr-1841(93))
(AD-696875; FML-Publ-69-5) Avail: CFSTI CSCL 18/3

The self-similar, one-dimensional flow behind a plane shock propagating upward into an exponentially decreasing atmosphere is considered. The flow is taken to be isothermal in view of the large radiation mean free paths associated with high altitudes and the intense radiation heat transfer accompanying the high temperature characteristic of an accelerating shock wave. The equations of motion are formulated in Lagrangian coordinates and are integrated exactly for all values of the shock density ratio. Solutions are presented for the cases where the boundary conditions at the shock correspond to a supercritical shock and to a Chapman-Jouguet shock. A significant result of the analysis is that in both of these cases the shock propagates much faster than for the case of adiabatic flow. Author (TAB)

N70-17084# Columbia Univ. New York. School of Engineering and Applied Science.
THE PHYSICS OF STRONG SHOCK WAVES IN GASES
Robert A. Gross Aug. 1969 81 p refs Submitted for publication
(Contract AF 49(638)-1634)
(AD-697061; AFOSR-69-2863TR) Avail: CFSTI CSCL 20/4

The physics of strong shock waves propagating in gases are studied. Fluid dynamical aspects are concisely summarized with particular emphasis given to the properties of very strong shock waves. Ionizing shocks, shocks in plasmas, and collisionless shock waves are discussed. Radiative shock waves are described within the framework of the equations of radiative gas dynamics, and relativistic shock waves with radiation are analyzed. The structure of a thermonuclear detonation wave is described and recent laboratory results obtained in experiments with high speed shock waves are summarized. Author (TAB)

N70-17101# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON STAGNATION-POINT CONDITIONS IN NONEQUILIBRIUM INVISCID BLUNT-BODY FLOWS

Marcel Vinokur Oct. 1969 54 p refs
(AD-696885; LMSC-6-78-69-36) Avail: CFSTI CSCL 20/4

In nonequilibrium inviscid blunt-body flows, the state of the gas at the stagnation point is known to be in thermodynamic equilibrium for all finite relaxation times. The dependence of this state on the nonequilibrium processes and body geometry is investigated for the most general conditions. The stagnation-point state is always found to be in a narrow range bounded on one side by the state obtained in an equilibrium flow. The other bound, called the frozen limit, is far removed from the state obtained in an identically frozen flow (infinite relaxation times). For certain state variables, the frozen-limit value lies outside the range determined by frozen and equilibrium flow. Significant errors are found in several published predictions of the stagnation-point state, resulting from the nonanalytic approach to equilibrium in nearly frozen flow. The two bounds on the pressure are expressible in terms of the normal shock density ratios for equilibrium and frozen flow. The actual pressure for an arbitrary flow situation is found to depend only on the shock nose radius and the relation between density and time in the relaxation zone behind a normal shock wave. If the density law is given by a single relaxation model, a closed form expression for the pressure is obtained. The analysis is carried out for both plane and axisymmetric flows, and is also valid for nonequilibrium free-stream conditions. Author (TAB)

N70-17106# Wisconsin Univ., Madison. Mathematics Research Center.
ON NONUNIQUENESS OF SOLUTIONS OF THE VON KARMAN EQUATIONS
George H. Knightly and D. Sather May 1969 25 p refs
Prepared in cooperation with Minn. Univ.
(Contract DA-31-124-ARO(D)-462; Grants AF-AFOSR-883-67; NSF GP-8413)
(AD-696925; MRC-TSR-983) Avail: CFSTI CSCL 12/1

A constructive method is used to study the nonuniqueness of solutions of a pair of non-linear partial differential equations (the von Karman equations) governing the deflections of a thin, flat, elastic plate that is clamped at the edges and subjected to combined normal and edge loading. In addition, although in general the solutions of the above problem are not unique, it is shown that, for sufficiently small normal and edge loading, uniqueness does prevail. Author (TAB)

N70-17113# IIT Research Inst., Chicago, Ill. Dept. of Mechanical and Aerospace Engineering.
REVIEW OF HYPERSONIC FLOW THEORY
C.Y. Yoo May 1969 21 p refs
(Grant NSF GK-2844)
(PDL-1-69) Avail: CFSTI

A literary review of free molecule, rarefied gas, viscous, and inviscid hypersonic flow theories is presented. Emphasis is on continuum boundary layer (high Re, low Kn), vorticity interaction, viscous layer, incipient merged layer, fully merged layer, transitional layer, first order collision theory, and free molecule flow regimes. Increasing Reynolds numbers with decreasing altitude as well as body shape and flow speed are used as a basis for classification. Boundary layer equations and compressible Navier–Stokes equations are referred to in viscous flow cases. Small disturbance, Newtonian, constant-density, and thin shock layer theories as well as numerical methods for blunt body and local supersonic flow are discussed for cases of inviscid hypersonic flow. J.M.

N70-17125# Brussels Univ. (Belgium). Inst. de Mecanique Appliquee.
CONTRIBUTION TO THE KNOWLEDGE OF MAGNETOHYDRODYNAMIC FLOWS OF DUCTED INCOMPRESSIBLE FLUIDS [CONTRIBUTIONS A LA CONNAISSANCE DES ECOULEMENTS MAGNETOHYDRODYNAMIQUES DE FLUIDES INCOMPRESSIBLES EN CONDUITE]
Andre Jaumotte and Charles Hirsch 1969 71 p refs In FRENCH
(ULB-IMA-NT-23-1969) Avail: CFSTI

Magnetohydrodynamic flow equations for real incompressible fluids in pipes with circular or triangular cross-sections are solved with the magnetic field parallel or perpendicular to the walls. Pressure drops in tubes with circular, square, or triangular cross-sections and insulated walls in variable magnetic fields were also evaluated. Measurements made on pipes with conducting walls are also reported. ESRO

N70-17173# Space Sciences, Inc., Waltham, Mass.
DRAG IN RAREFIED GASES Final Report
Pung Nien Hu [1969] 15 p refs
(Contract AF 49(638)-1666)
(AD-697066; AFOSR-69-2871TR) Avail: CFSTI CSCL 20/4

The long term and short term objectives of the research program are described. Various problems that have been singled out for investigation are categorized in five main areas; namely, the drag problem, the diffusion problem, the thermal escape problem, the shock structure problem, and the plasma-body interaction problem. Brief descriptions of these areas as well as a list of publications that summarize the results of the studies are given. Author (TAB)

N70-17206# Applicazioni e Ricerche Scientifiche, Milan (Italy).
RECENT PROGRESS IN RAREFIED GAS DYNAMICS Summary Scientific Report, 1 Aug. 1968 – 31 Jul. 1969
Carlo Cercignani 31 Jul. 1969 15 p refs
(Contract F61052-68-C-0020)
(AD-696689; AFOSR-69-2714-TR) Avail: CFSTI CSCL 20/4

This report summarizes the work done at A.R.S. in the field of rarefied gas dynamics under contract with A.F.O.S.R. during the period from 1 August 1968 to 31 July 1969. After an introduction describing the essential mathematical tools for a theoretical investigation on the behavior of rarefied gases in the so-called transition regime, two main lines of work are reviewed in some detail, i.e. the research for new methods for finding approximate solutions of the linearized Boltzmann equation and the investigation of physically realistic boundary conditions to be matched with the Boltzmann equation. Author (TAB)

N70-17212# Webb Inst. of Naval Architecture, Glen Cove, N.Y.
LECTURE NOTES ON CONFORMAL MAPPING TECHNIQUES IN SHIP HYDRODYNAMICS Final Report
Dan Hoffman Jun. 1969 55 p refs
(Grant Nonr(G)-00009-68)
(AD-696655; Webb-41-1) Avail: CFSTI CSCL 20/4

A short survey is given of conformal mapping concepts in relation to added mass evaluation. A revised formulation of published two- and three-parameter mapping functions is presented. Reference is made to free surface effects on added mass calculations. A review of other existing mapping methods illustrates the need for a more accurate mapping procedure. Comparison of results obtained by the authors procedure with those obtained by the Schwarz-Christoffel method for simple geometric shapes indicates excellent agreement. A summarized presentation is given in graphical and tabulated form of added mass coefficients for various types of two-dimensional cylinders simulating a wide variety of ship sections. Author (TAB)

N70-17221# Oxford Univ. (England). Engineering Lab.
FLUCTUATION MEASUREMENTS IN COMPRESSIBLE BOUNDARY LAYERS
F. K. Owen Mar. 1969 20 p refs
(Rept-1-076-69) Avail: CFSTI

Fluctuation measurements in the boundary layer on a flat plate were made at Mach numbers between 2.5 and 4.5. The results show that intense fluctuations exist in the laminar boundary layer before the onset of transition, and that their behavior closely follows the trend predicted by stability theory. Fluctuation profiles

in transitional and fully turbulent boundary layers are also reported. Author (ESRO)

N70-17225# Grenoble Univ. (France). Faculte des Sciences.
PHENOMENA OF TURBULENT HORIZONTAL TRANSPORT AND DIFFUSION IN THE TIDAL COASTAL SEAS AND APPLICATION TO THE ENGLISH CHANNEL [PHENOMENES DE TRANSPORT TURBULENT HORIZONTAL ET DE DISPERSION DANS LES MERS LITTORALES A MAREE ET CAS PARTICULIER DE LA MANCHE]
Jean-Louis Hyacinthe (Ph.D. Thesis, 30 May 1969) [1969] 179 p refs In FRENCH
(Contracts CEA-5236-R; CEA-6132-r)
Avail: CFSTI

Classical results on the homogeneous or isotropic turbulent transport properties of an incompressible fluid are compared. Theoretical and experimental results for marine and oceanic turbulent flows and horizontal turbulent transport are summarized and applied to tidal coastal waters, especially those of the English Channel. A direct experiment using buoys and coloring materials was carried out in order to choose between different hypotheses and scale laws. A rotating hydraulic model was designed to simulate tidal effects in the English Channel in order to evaluate nuclear waste disposal sites. ESRO

N70-17228# Texas Univ., Arlington. School of Engineering.
FLOW PARAMETERS ON A FILM COOLED SURFACE
A. Haji-Sheikh [1969] 12 p refs Presented at the 4th Intern. Heat Transfer Conf., Paris, 1970
(Grant NSF GK-1569)
(ME-69-02) Avail: Issuing Activity

A new procedure is devised and successfully used for prediction of flow parameters in a turbulent flow over a film cooled surface. The results are in good agreement with experimental data of other investigators. The procedure for calculating so called film cooling effectiveness is discussed. The method is extended to incorporate the case of variable main stream velocity outside of the boundary layer. Author

N70-17233# IIT Research Inst., Chicago, Ill. Plasma Dynamics Lab.
CHARACTERISTICS AT BOUNDARIES IN NUMERICAL GAS DYNAMICS
Robert W. Porter and James F Coakley Nov. 1969 24 p refs
(Contracts NSF GK-16265; NSF GK-2844)
(PDL-2-69) Avail: Issuing Activity

Relations from the theory of characteristics are used to connect boundary and interior points in the unsteady method of numerical gas dynamics. The choice of a particular vector on the characteristic surface results in a compatibility relation containing partial derivatives tangent to the boundary only. This avoids extrapolation and the subsequent generation of a pseudo boundary layer of the numerical solution of the field equations used in the interior. For the case of a moving shock discontinuity, the tangential derivatives are evaluated analytically. This is important in uncoupling shock boundary points in advancing time. The cases of a solid wall and of a downstream surface in locally supersonic flow are also considered. Author

N70-17324*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PULSATING FLOW OF A CONDUCTING FLUID IN A PLANE CHANNEL [PUL'SIRUYUSHCHEYE TECHNIYE PROVODYASHCHEY ZHIDKOSTI V PLOSKOM KANALE]
K. Ye. Dzaugashtin and B. L. Mintsberg Washington NASA Jan. 1970 5 p refs Transl. into ENGLISH from Magnitnaya Gidrodinamika, (USSR), v. 5, Jan.-Mar. 1969 p 71-73
(Contract NASw-1692)
(NASA-TT-F-12,634) Avail: CFSTI CSCL 20D

A solution is presented to the problem of a laminar flow of incompressible conducting fluid in a plane channel in a transverse magnetic field under the action of a pressure drop which pulsates relative to its mean value. The influence of amplitude and frequency of the oscillations on the resistance of the channel and the influence of the magnetic field on the intensity of the pulsations are analyzed. Author

N70-17333# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Eastern Div.
A VELOCITY PROFILE CORRELATION AND PREDICTION PROCEDURE FOR COMPRESSIBLE TURBULENT BOUNDARY LAYERS INCLUDING EFFECTS OF HEAT AND MASS TRANSFER
T. J. Kane 21 Mar. 1969 82 p refs
(H072) Avail: CFSTI

A velocity profile correlation and prediction procedure is presented for compressible turbulent boundary layers on sharp leading edge flat plates including the effects of heat transfer and mass injection. This procedure provides convenient expressions describing the entire velocity profile from the wall to the outer edge of the boundary layer. Three parameters, C, n, and pi, are necessary for the correlations and may be determined from experimental profiles. Prediction equations for these quantities were obtained by means of a multiple regression analysis. Predicted velocity profiles are presented for an approximate Mach number range of 3 to 6.5 and in general show fair agreement with the measured profiles. Author

N70-17362*# Illinois Univ., Chicago. Dept. of Energy Engineering.
CHEMICAL REACTION IN A TURBULENT FLOW FIELD WITH UNIFORM VELOCITY GRADIENT
Paul M. Chung Jun. 1969 41 p refs
(Grant NGL-14-012-012)
(NASA-CR-107856; TR-E27) Avail: CFSTI CSCL 20D

A simplified statistical theory for turbulent shear flows is developed until it is completely self-containing in the flow region where the turbulence Reynolds number is sufficiently large. The theory, applies in the region outside of the laminar sublayers. The homologous flow and concentration fields are first analyzed for the chemically frozen case. From the analyses, the relationships between the mean velocity and concentration gradients, and the Reynolds stress, turbulence energy, turbulent transport of chemical species, and the mean square fluctuation of the species concentration are established. The comparison of the present results with the available experimental data is made, which shows a satisfactory agreement. The non-equilibrium chemical reaction was found to create an inhomogeneity in the concentration field which, among other things, causes the mean square fluctuation to vary nonuniformly with respect to the Damkohler number and the flow region. Author

N70-17371*# Applied Theory, Santa Monica, Calif.
NUMERICAL CALCULATIONS OF VISCOUS COMPRESSIBLE FLUID FLOW AROUND A STATIONARY CYLINDER
John G. Trulio and Leonard Walitt Washington NASA Jan. 1970 105 p refs
(Contract NAS8-18034)
(NASA-CR-1465) CSCL 20D

Numerical calculations were made of vortex formation, development, and shedding about a right circular cylinder immersed in a compressible viscous fluid. A computer code (AFTON 2F) which solves the equations of motion of a general continuous medium for two dimensional plane symmetric systems, was used for the computations. The numerical data were generated for a Mach number of 0.20 and Reynolds numbers of 100 and 1000. Convergence of the numerical solutions obtained in the program was demonstrated with two different finite difference meshes, both of which provided unusually large mesh point densities. The pressure

coefficient field, which received particularly close scrutiny, differed by no more than a few percent in the two cases. Author

N70-17400*# Purdue Univ., Lafayette, Ind. Fluid Mechanics Group.
APPLICATION OF THE METHOD OF WEIGHTED RESIDUALS TO THE TURBULENT BOUNDARY-LAYER EQUATIONS. PART 1: THE METHOD OF WEIGHTED RESIDUALS AS A SOLUTION TECHNIQUE. PART 2: A TWO PARAMETER PREDICTION TECHNIQUE
Douglas E. Abbott, George S. Deiwert (NASA. Ames Res. Center), Victor G. Forsnes, and Gail R. Deboy [1969] 61 p refs Presented at AFOSR-IFP-Stanford Conf. on Computation of Turbulent Boundary Layers, Stanford, Calif., 1968 Sponsored in part by NASA
(Contract DA-31-124-ARO(D)-479)
(NASA-CR-107695; AD-689496; AROD-6340-3-E) Avail: CFSTI CSCL 20D

The paper describes a particular mathematical solution technique, the method of weighted residuals or MWR. During this description, the MWR is compared with other techniques used to analyze the turbulent boundary-layer problem and certain special cases or variations of the method are pointed out as they arise at various stages of the development. Finally, after the basic analytical technique is formulated, several possible physical inputs are discussed and some typical experimental and semi-experimental formulations are shown. Author

N70-17413# United Kingdom Atomic Energy Authority, Harwell (England).
FILM THICKNESS MEASUREMENT IN ANNULAR TWO-PHASE FLOW USING A FLUORESCENCE SPECTROMETER TECHNIQUE. PART 2: STUDIES OF THE SHAPE OF DISTURBANCE WAVES
G. F. Hewitt and B. Nicholls May 1969 13 p refs
(AERE-R-4506) Avail: CFSTI; UK: 2s 6d

A set of experiments is described in which the shape in space of the large disturbance waves in annular flow was determined by use of the fluorescence technique, in order to obtain amplitude time data, together with conductance probes to allow a simultaneous velocity measurement. The waves were typically of amplitude 5 times the mean liquid film thickness and had an axial length dimension of the order of 1/2 to 1 inch. Author (NSA)

N70-17427# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
EXPERIMENTAL AERODYNAMICS Final Scientific Report
Robert O. Dietz 30 Sep. 1969 9 p
(Grant AF-EOAR-68-0029)
(AD-696688; AFOSR-69-2710TR) Avail: CFSTI CSCL 20/4

The report describes the research of each of seven American research assistants conducting aerodynamics research at the von Karman Institute for Fluid Dynamics. Of particular interest is the research on flat plate pressure distribution and heat transfer in a conical hypersonic flow. Author (TAB)

N70-17474# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
OPTIMIZATION OF HEAVILY LOADED COMPRESSOR BLADES BASED ON BOUNDARY LAYER THEORY [OPTIMIZATION D'AUBAGES DE COMPRESSEUR A FORTE CHARGE SUR LA BASE DES THEORIES DE COUCHES LIMITES]
Kyriacos Papailiou (Ph.D. Thesis—Liege Univ.) Sep. 1969 217 p refs In FRENCH; ENGLISH summary
(VKI-TN-55) Avail: CFSTI

The present investigation is concerned with the development of a theoretical method attacking one of the main requirements of axial compressors: the design of blades with high loadings. In the course of the analysis, methods are proposed to deal with the two basic elements of the design, i.e., the circulation per blade and the losses. These methods are grouped in an optimization procedure which requires the application of trial and error methods as there is no simple mathematical relation between the two elements of the optimization. This fact makes the use of a computer indispensable to the solution of the problem. The theory is applied to the design of a compressor cascade of 45 deg of turning back to axial direction. The designed cascade has been tested in a low speed cascade tunnel C-1. Theoretical and experimental results are compared and discussed. They lead to a critical examination of the methods used and to suggestions for further developments. Author (ESRO)

N70-17530*# Illinois Univ., Urbana.
RAREFIED GAS DYNAMICS
S. M. Yen, B. L. Hicks, W. Chow, W. H. Chu, A. Nordsieck et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 108–113 (See N70-17526 06-34)
(Contract N00014-67-A-0305-0001)
Avail: CFSTI CSCL 20D

More accurate Monte Carlo solutions of the Boltzmann equation were obtained for the pseudoshock and the heat transfer problems by using the new techniques developed. These solutions and the solution of the shock wave problem permit detailed studies of the nonequilibrium gas behavior in rarefied gas flow problems. These studies include the investigation of the effect of the gas-surface interaction on the gas behavior near a solid surface. Because of the improvement of the accuracy of evaluating the Boltzmann collision integrals, the study to near – equilibrium conditions was extended. The second order effect of the Chapman–Enskog's distribution function on the collison integral is being studied. More error studies of our Monte Carlo method were conducted to establish a firm basis for tackling more complex problems. The initial phase to extend the application of this Monte Carlo method to more complex problems by using a large scale parallel operation computer is completed. Author

N70-17615# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
INVESTIGATION OF INTERFACIAL PHENOMENA IN ANNULAR TWO-PHASE FLOW BY MEANS OF THE AXIAL VIEW TECHNIQUE
G. F. Hewitt and D. N. Roberts Jun. 1969 33 p refs
(AERE-R 6070) Avail: CFSTI; HMSO 10s; BIS $2.10

By using a specially designed separator device it was possible to view annular two phase flow along the axis of a tube in such a way that a clear view of the oncoming flow, and particularly the wave structure, was obtained. Investigations of the effect of phase flowrates on the wave structure and the effect of length on wave development were carried out and are reported. In general, for a given gas flowrate, the activity of the waves and droplet entrainment increases with increasing liquid rate. At a given liquid rate, the amount of droplet entrainment and the amplitude and complexity of the interfacial structure decrease with gas rate as the regime transition between churn flow and annular flow is traversed. At high gas rates the amount of droplet entrainment increases again. In the churn flow region, over the range of gas flowrates studied, there was no visible sign of bridging across the tube. The studies of the effect of length showed how the disturbance waves grew continuously from the point of liquid injection. Frame-by-frame studies of high-speed movie films using the axial view technique indicated a number of possible break-up mechanisms. Author (NSA)

N70-17632# Brown Univ., Providence, R.I. Div. of Engineering.
KINETIC MODEL EQUATIONS IN RAREFIELD GAS DYNAMICS Final Scientific Report, 1 Dec. 1963–30 Nov. 1968
T. F. Morse 17 Feb. 1969 7 p refs
(Contract AF 49(638)-1326)
(AD-696656; AFOSR-69-2746TR) Avail: CFSTI CSCL 20/4

The report contains abstracts of 10 major publications on the subject of kinetic theory of gases. Author (TAB)

N70-17638# Eidgenoessisches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
FLOW FORM, STEAM VOLUME FRACTION, AND PRESSURE IN TWO-PHASE FLOW OF WATER-STEAM IN TUBES [STROEMUNGSFORM, DAMPFVOLUMENANTEIL UND DRUCKABFALL BEI ZWEIPHASENSTROEMUNG VON WASSER-WASSERDAMPF IN ROHREN
A. Kuetuekcueoglu Jun. 1969 158 p refs In GERMAN
(EIR-145) Avail: AEC Depository Libraries

The local distribution of the liquid and the mean steam volume fraction can be determined from the attenuation of a collimated gamma beam through a tube through which a two-phase mixture of water and steam is flowing. Simultaneously the total pressure drop and the friction loss were determined. In vertical tests the measurement results were higher than in the horizontal flow direction. As the heat charge increased the mean steam volume fraction increases. In the vicinity of the channel wall the radial steam volume fraction pattern can be described with a logarithmic function. From the radial steam volume fraction pattern the density of the liquid film on the channel wall can be determined approximately. High mass and heat flow densities and mass flow ratios of the steam lead to smaller film thicknesses. At high mass flow densities the fraction of the pressure difference was small. The pressure difference at high heat charge can affect significantly the total pressure drop. NSA

N70-17672 Cincinnati Univ., Ohio.
LAMINAR MAGNETOHYDRODYNAMIC CHANNEL FLOW WITH WEAK INTERACTION
Edward Shu-Jen Hsia (Ph.D. Thesis) 1968 205 p
Avail: Univ. Microfilms. HC $9.25/Microfilm $3.00 Order No. 69-6342

The weakly interacted magnetohydrodynamic entrance flow of an incompressible electrically conducting fluid in a two dimensional constant area channel was investigated by the usual integral method. It is assumed that a uniform magnetic field is applied transversely to the flow field and an electric field, which applied perpendicularly to both the magnetic field and mean flow, is permitted. The magnetic Reynolds number, which is assumed vanishingly small in most of the previous studies, is assumed of order of one in the present study so that the variation of the magnetic field can be investigated. Particular emphasis is placed on the effects of wall electrical conductivity to the flow field, as a matter of fact, this problem has not been reported yet for considering the flow development in entrance region as influenced by the wall conductane. The growth behavior of velocity, magnetic and temperature profiles in a MHD channel entrance are also obtained. Dissert. Abstr.

N70-17678 Tennessee Univ., Memphis.
A MOMENTUM THEORY FOR THE EFFECTS OF CROSS FLOW ON INCOMPRESSIBLE TURBULENT JETS
Jack Donald Mc Allister (Ph.D. Thesis) 1968 146 p refs
Avail: Univ. Microfilms. HC $7.00/Microfilm $3.00 Order No. 69-7167

The major effects produced by the addition of cross flow to a turbulent jet were investigated. The methods of attack included visual flow observation, analytical study, and additional analysis of previously published measurements. Jet trajectories were observed over a range of jet to free stream velocity ratios for three jet entry angles and two different conditions for the surface surrounding the jet exit. The jet external flow interaction was shown to be predominately a mixing phenomenon that may be evaluated by a control volume analysis. This analysis provided both both numerical and approximate analytical solutions for the jet trajectory. These solutions were correlated with measured trajectories in terms of a function depending only on a statistically defined velocity ratio. A brief analysis of buoyancy effects was accomplished to establish the conditions for these forces to significantly alter the jet trajectory. Dissert. Abstr.

N70-17694# Cambridge Univ. (England).
RADIATION STRESS IN FLUID DYNAMICS
F. P. Bretherton *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 47-53 refs (See N70-17690 06-13)
Avail: CFSTI

For a suitable definition of the energy of a wave in a moving fluid a given conservation law is valid when the mean velocity is slowly varying with respect to the length and period of the wave. A Hamiltonian function is derived for the total motion of the system and the part corresponding to the linearized perturbation around a reference flow is extracted by using the Langrangian formulation. An averaging principle is applied to obtain the averaged Langrangian for the linearized motion. For waves propagating through a mean flow there is a back effect exerted by the waves on the medium. R.B.

N70-17695# Toronto Univ. (Ontario).
THE GENERATION OF TRAVELING IONOSPHERIC DISTURBANCES BY AURORAL CURRENTS
G. Chimonas *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 55-65 refs (See N70-17690 06-13)
Avail: CFSTI

Records from ionosonde tracking indicate that traveling ionospheric disturbances in the Northern Hemisphere generally move southward, while such disturbances in the Southern Hemisphere generally move northward away from the polar regions. The possible correlation between these disturbances and auroral effects or magnetic substorms is investigated. A radio system with three receivers is usually used to determine such a correlation. A possible mechanism by which auroras could generate long wavelength, low frequency disturbances is considered. There is a line current in the aurora which can interact with the magnetic field to give a current-field transfer of momentum to the atmosphere. The magnitude and distribution of current discharge that could generate disturbances observed at large distances from the polar regions are investigated by numerical methods. R.B.

N70-17696# Toronto Univ. (Ontario).
SECOND ORDER PERTURBATIONS: ENERGY DENSITY AND ENERGY FLUX
C. O. Hines *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 67-76 refs (See N70-17690 06-13)
Avail: CFSTI

Full hydrodynamic equations are combined quite generally to form an expression for advected and propagated or transmitted energy which passes from one fluid parcel to the next. From the basic equations, perturbation equations can be formed and perturbation solutions deduced for energy density and flux. R.B.

N70-17697# National Center for Atmospheric Research, Boulder, Colo.
STABILITY IN INTERNAL GRAVITY WAVES: RAY TRACING IN INTERNAL GRAVITY WAVES
W. L. Jones *In its* Internal Gravity and Acoustic Waves Sep. 1969 p 77-102 refs (See N70-17690 06-13)
Avail: CFSTI

In consideration of stability for internal gravity wave propagation through stably stratified shearing fluids, the question is posed about what conditions permit the fluid to become sufficiently unstable to allow oscillations. The problem considered involves some form of forcing term, possibly appearing as a boundary condition, so that the governing equations are inhomogeneous, and the eigensolutions have time-growing behavior corresponding to

oscillations of the fluid. The investigation is an extension of previous work to small values of Richardson number, a dimensionless quantity which expresses the ratio of the stabilizing effect of the density stratification to the destabilizing effect of the wind shear. A series of perturbation equations is also derived for ray tracing in internal gravity waves, which involves the assumption that the coefficients of the dispersion equation vary slowly with time, with the result that the energy propagation is everywhere wavelike in character. R.B.

N70-17698# National Center for Atmospheric Research, Boulder, Colo.

NONLINEAR MOUNTAIN FLOW. PART 1: APPLICATION OF THE THEORY OF WEAK SOLUTIONS TO THE SHALLOW WATER EQUATIONS

Akira Kasahara and David D. Houghton *In its* Internal Gravity and Acoustic Waves Sep. 1969 p 103–114 (See N70-17690 06-13)

Avail: CFSTI

The motions of an incompressible, homogeneous, inviscid, and hydrostatic fluid can be described by the system of 'shallow water' equations. It is demonstrated that the solutions of the problem containing shock discontinuities are in general not unique even for the same initial conditions. Shock solutions associated with a given system of equations depend on the form in which the equations are written. When the system of equations is solved numerically in finite difference form, the question of non-uniqueness of shock solutions becomes difficult to answer because of the accuracy of the finite difference equations. The example presented shows clearly that the non-uniqueness of shock solutions can be demonstrated in numerical as well as in analytical solutions of differential equations. R.B.

N70-17699# National Center for Atmospheric Research, Boulder, Colo.

NONLINEAR MOUNTAIN FLOW. PART 2: APPLICATION OF A TWO-LAYER MODEL TO REAL ATMOSPHERIC CONDITIONS

David D. Houghton and Akira Kasahara *In its* Internal Gravity and Acoustic Waves Sep. 1969 p 115–130 refs (See N70-17690 06-13)

Avail: CFSTI

The simple nonlinear approach for flow over an obstacle is extended to real atmospheric conditions. In the real atmosphere many dispersive processes act to inhibit the growth of large horizontal gradients, but it is presumed that in certain extreme mountain flow cases a discontinuity is a good approximation to the large horizontal gradients that may develop. Based on synoptic features observed during periods of significant orographic-induced motions over the Rocky Mountains, it was concluded that a model with two dynamically active layers and a third passive layer at the top would be a reasonable gross approximation to the atmosphere. The model approximations were the same as for the one-layer model in which the flow was incompressible, homogeneous, and two-dimensional, rotation and viscosity were ignored, and pressure was hydrostatic. From field observations and numerical integration of the time-dependent equations derived, it is suggested that a single downdraft describes the high velocities observed on the lee slopes of mountain ridges. R.B.

N70-17704# National Center for Atmospheric Research, Boulder, Colo. Desert Research Inst.

VELOCITY GRADIENTS IN INTERNAL ACOUSTIC GRAVITY WAVES

Alden Mc Lellan, IV *In its* Internal Gravity and Acoustic Waves Sep. 1969 p 201–227 refs (See N70-17690 06-13)

Avail: CFSTI

Two modes of wave propagation generally exist in a compressible medium under the influence of gravity. One, called the acoustic mode, is that in which the compressibility of the medium is the predominant restoring force. In the other, or gravity mode, the force of gravity is the primary restoring force. Small amplitude waves are considered in an isothermal, compressible fluid medium with a velocity gradient and within a constant gravitational field. A local dispersion relation governing the wave propagation for constant velocity gradients is derived from the linearized equations of fluid dynamics and thermodynamics and arranged in a non-dimensional form, independent of the constants describing a particular atmosphere. The wave modes are discussed and the amplitude growth rates which depend on the angle of wave propagation and velocity gradient strengths are determined for each wave mode. A first order differential equation is obtained for the wave phase using a WKB approximation. All dissipative effects are ignored. Author

N70-17706# Imperial Coll. of Science and Technology, London (England).

PRESENT STATE OF THE THEORY OF LARGE AMPLITUDE OSCILLATIONS IN STRATIFIED FLUIDS

Richard S. Scorer *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 259–281 ref (See N70-17690 06-13)

Avail: CFSTI

An attempt is made to see what approximations are necessary in order to obtain a linear differential equation for fluid displacement. The Bernoulli theorem is used as an example of an exact integration of the equation of motion for fluid parcels and is an example of a large amplitude equation since it contains the velocity of the fluid parcel squared. Since the equation is essentially an energy conservation equation, it is obtainable only when the fluid motion is reversible, and thus all forms of energy dissipation are neglected. In order to study waves, it is necessary to keep vorticity in the results, which requires the assumption of steady flow. R.B.

N70-17707# Imperial Coll. of Science and Technology, London (England).

LARGE AMPLITUDE WAVES

Richard S. Scorer *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 283–290 (See N70-17690 06-13)

Avail: CFSTI

The two-dimensional wave equation for the atmosphere is derived from the usual equations of momentum and continuity. If viscosity, heat conduction, and Coriolis effects are neglected, the steady state wave equation for vertical displacement is obtained for a plane parallel atmosphere with vertical wind shear and density stratification. If the x variation of vertical displacement is assumed to be exp ikx, the wave equation for small perturbations is derived and can be solved numerically. Three examples are given of propagation and vertical displacement profiles and the resulting appearance of rotors in the atmosphere. R.B.

N70-17708# Imperial Coll. of Science and Technology, London (England).

MECHANISMS OF CLEAR AIR TURBULENCE

Richard S. Scorer *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 291–308 refs (See N70-17690 06-13)

Avail: CFSTI

An attempt is made to find a criterion for describing clear air turbulence. Richardson number is applied to changes in the velocity and temperature profiles of the atmosphere. The complete vorticity equation for inviscid flow is derived for forward shear generated by inclined motion. The mechanisms described are believed most likely to operate in mountain and lee waves and in jet streams. R.B.

N70-17710# Imperial Coll. of Science and Technology, London (England).

THE INITIAL VALUE PROBLEM AND SOME THEORETICAL CALCULATIONS OF VERTICAL MECHANICAL WAVE ENERGY FLUX

F. W. G. Warren *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 323–327 refs (See N70-17690 06-13)
Avail: CFSTI

Since an explosive type disturbance in the lower atmosphere excites both gravity and compression waves, a Fourier theory is presented for the dispersion and calculation of the associated net energy flux through a level at a certain height above the ground. The initial disturbance may be specified in terms of a perturbation of the lowest level and the governing equation is written in terms of the modified pressure and vertical displacement of the air particles. R.B.

N70-17712# Adelphi Univ., Garden City, N.Y.
EFFECT OF VISCOSITY ON GRAVITY WAVES AND THE UPPER BOUNDARY CONDITION
M. Yanowitch *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 391–401 ref (See N70-17690 06-13)
Avail: CFSTI

In considering the problem of wave motion in an incompressible, isothermal atmosphere with an exponentially varying equilibrium density, the variations of velocity, pressure, and density from the steady state are treated as small perturbations by linearizing the equations of continuity, motion, and state. At high altitudes the original assumption of small perturbations is no longer true and the necessary boundary conditions add a second difficulty. If a dissipative mechanism such as viscosity is added to the problem, at high altitudes it will tend to damp the vertical and horizontal motion, and the linear theory for small perturbations is again valid. R.B.

N70-17724*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SENSING MOLECULAR WEIGHTS OF GASES WITH A FLUIDIC OSCILLATOR
Milton J. LeRoy, Jr. and Sol H. Gorland Washington Jan. 1970 16 p refs
(NASA-TM-X-1939; E-5343) Avail: CFSTI CSCL 20D

A fluidic oscillator was investigated for use as a molecular-weight sensor of gases. Data were taken using monatomic and polyatomic gases having molecular weights from 4 to 83.8. From test results, it was observed that for choked flow or constant pressure drop the oscillator frequency is proportional to the sonic velocity in the medium but the monatomic and polyatomic gases have a different constant of proportionality. The effect of changes in pressure drop and temperature on oscillator frequency is also discussed. Author

N70-17764 Texas Univ., Austin.
VERTICAL PERMEABILITY AND INTERSTRATA FLOW
Ronald Leon Lewis (Ph.D. Thesis) 1968 104 p refs
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-6176

Results of studies conducted on two-strata fluid flow models are compared with and without reduction of vertical permeability between the strata. A three-strata model representing an intermediate between models with no restriction to vertical flow between strata and no flow between strata was constructed. A thin, low-permeability stratum was inserted between two higher permeability strata. Interstrata flow was studied for favorable and unfavorable mobility ratios and for a range of permeability ratios. The effects of capillary pressure and gravity were eliminated to study singly the effects of the viscous-induced interstrata flow on the sweep efficiency in the system. Observations of the fluid front geometry and the production rates of the strata are presented. A detailed review of viscous-induced interstrata flow is also included in this work. Dissert. Abstr.

N70-17888# Army Foreign Science and Technology Center, Washington, D.C.
RESEARCH, CONSTRUCTION, AND OPERATION COEFFICIENTS OF DISCHARGE THROUGH AN ORIFICE ROUTE AT THE VANES IN TURBINE STAGES
N. M. Markov et al 14 Oct. 1969 17 p Transl. into ENGLISH from Energomashinostroenie, (USSR), v. 14, no. 5, 1968 p 1–4
(AD-696191; FSTC-HT-23-544-69) Avail: CFSTI CSCL 13/7

The magnitude of the coefficient phi sub 3 across an orifice at the route of the vanes substantially depend on the direction of leaks and construction of packing of the route orifice. Therefore, during calculations, the quantity phi sub 3 should be selected in accordance with these parameters. The most expedient type of packing of the route orifice is radial-axial. Utilization of resigned values of the coefficient phi sub 3 through the orifice of the route of the vanes in calculations leads to substantial corrections in the value of flow and axial force in the turbine stage. Author (TAB)

N70-17872# Aix-Marseilles Univ. (France). Inst. de Mecanique des Fluides.
INCIDENCE, BLUNTNESS, AND REYNOLDS NUMBER EFFECTS OF A CIRCULAR CONE ON THE HYPERSONIC WAKE CONFIGURATION [ETUDE DE L'EFFET DE L'INCIDENCE, DE L'EMOUSSEMENT ET DU NOMBRE DE REYNOLDS SUR LA CONFIGURATION DU SILLAGE HYPERSONIQUE D'UN CONE CIRCULAIRE]
31 Dec. 1968 97 p refs In FRENCH Sponsored in part by ONERA
(ONERA-NT-4/1188-AX; Rept-510-521)

In this phase of a study on the wake of a circular cone placed in a hypersonic flow at Mach 7, the combined effects of the incidence angle, Reynolds number, and the bluntness of the cone are collected on graphs of equal pitot pressure in the symmetrical plane and the normal plane. Head, lip, and recompression shock wave characteristics are deduced from the graphs. Data on the pointed cone where Reynolds number is 25,000/cm are in disagreement with standard authorities. Transl. by M.H.E.

N70-17873# Aix-Marseilles Univ. (France). Inst. de Mecanique des Fluides de Marseille.
HIGH ENTHALPY BOUNDARY LAYER FLOW AROUND A REVOLVING BODY WHEN THE LONGITUDINAL PRESSURE GRADIENT IS EITHER NEGATIVE OR POSITIVE [ETUDE DE LA COUCHE LIMITE DANS L'ECOULEMENT A HAUTE ENTHALPIE AUTOUR D'UN CORPS DE REVOLUTION, LORSQUE LE GRADIENT LONGITUDINAL DE PRESSION EST, SOIT NEGATIF (GRADIENT FAVORABLE), SOIT POSITIF (GRADIENT DEFAVORABLE)]
R. Marmey and J. P. Guiberga [1969] 93 p refs In FRENCH
(Contract DRME-67-34-591-00-480-75-01)
Avail: CFSTI

Nozzle modifications in an interchangeable collar are investigated in their effects on shock tunnel gas mixtures zones. Heat transfer and heat flux measurements demonstrate separation phenomena effecting the turbulent and the laminar boundary layers. New shock wave effects under high enthalpy conditions are documented. In addition, the flow characteristics around a rotating body where the meridions are the arcs of circles tangent to the generator of the cone are determined. Nonviscous flow around the conical point is analyzed according to the method of characteristics. This method applies to flow conditions at the exterior forward edge of the boundary layer of a rotating body. Applicability to the determination of the boundary layer parameters in the presence of a positive pressure gradient is suggested. Transl. by M.H.E.

N70-17880# McGill Univ., Montreal (Quebec). Mechanical Engineering Research Labs.
AN EXPERIMENTAL STUDY OF THE THERMAL WAKE INTERFERENCE BETWEEN CLOSELY SPACED WIRES OF AN X-TYPE HOT WIRE PROBE
D. E. Guitton and R. P. Patel Jun. 1969 44 p refs
(Grant DRB-G-9551-12)
(Rept-69-7) Avail: CFSTI

A Disa X-type probe is tested and found to have a sensitivity to small angles of pitch, which is very significant for low wire Reynolds numbers (< 5) but becomes small for Reynolds number greater than 10. A modified probe, having the wires one wire length apart, is suggested and when tested found to have no pitch sensitivity. Author

N70-17891 Texas Univ., Austin.
MACRO-TURBULENCE IN WIND WAVES
Chin-Yuan Lee (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-6175

Wind wave induced turbulence is an important factor in the phenomena of mixing and dispersion in any natural water body. However, since it is impossible to model desired wave conditions in the field and there are technical difficulties involved in field measurements, a laboratory study of wind wave induced turbulence was made in a 70 foot long wave flume. The purpose of this investigation was to examine the nature of turbulent fluctuations associated with wind waves created in the wave flume, to provide basic information for better understanding of the role of wind wave induced turbulence in promoting mixing and dispersion in reservoirs, lakes, and the oceans. The results show that the depth of penetration of the macroscale turbulence induced by wind waves increases rapidly with wind speed in the flume when the wind speed is relatively low, but the rate of increase diminishes as the wind speed increases. The rate of increase of the depth of penetration with the characteristic wave height or wave length also diminishes as the latter values increase in magnitudes. Dissert. Abstr.

N70-17999 Michigan State Univ., East Lansing.
GENERALIZATION OF NORMAL SHOCK THEOREMS TO MAGNETOGASDYNAMICS WITH RADIATION
Ram Mohan Srivastava (Ph.D. Thesis) 1968 67 p refs
Avail: Univ. Microfilms: HC $3.80/ Microfilm $3.00 Order No. 69-5958

The present work is primarily concerned with the generalization of normal shock theorems by Courant and Friedrichs valid in isentropic, inviscid, non-heat conducting fluids to radiation-magnetogasdynamics. In the process, few generalized Rankine-Hugoniot relations and generalized Prandtl relations have been derived. Also, the generalized Hugoniot function has been defined, and the shape of the Hugoniot curve in the (p,v)-plane has been determined. In the main part of this work one-dimensional, uniform, and steady state flow of an electrically conducting, fully ionized and compressible gas under a planar magnetic field perpendicular to the velocity vector has been assumed. Only first approximations for radiation parameters, for an optically thick medium, have been considered. The shape of the Hugoniot curve, in the (p,v)-plane has been found to be similar to the one in classical gasdynamics. The generalized Rankine-Hugoniot relations are in implicit form, hence, successive approximation technique has to be used to find the corresponding state behind the shock front. Dissert. Abstr.

N70-18003 Texas Univ., Austin.
A THEORETICAL SOLUTION OF THE HYPERVELOCITY IMPACT PROBLEM
John Lindsey Whitesides, Jr. (Ph.D. Thesis) 1968 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-8238

The effects on a stationary target caused by the impact of a high velocity spherical projectile are investigated. The motion of the impacted material is represented by the flow of a viscous, compressible fluid with spherical symmetry. The material density behind the shock front is assumed to vary as a power function of the radial position of the material. The particle velocity and pressure profiles are obtained from analytic integrations of the continuity and momentum equations, respectively. These distributions are functions of the shock position and velocity. An energy balance at any time is effected to obtain this shock trajectory. The pressure, density and particle velocity in the target are then completely determined. The normal stress distribution and the shock trajectory obtained in this solution compare favorably with the experimental data available. The effect of viscosity on the flow variables is shown to be more pronounced as the shock strength decreases. Dissert. Abstr.

N70-18030 Maryland Univ., College Park.
VOID-FRACTION AND MASS-TRANSFER PREDICTION IN VERTICAL COCURRENT AIR-WATER FLOW
Ronald Willard Brown (Ph.D. Thesis) 1967 340 p
Avail: Univ. Microfilms: HC $15.30/Microfilm $4.35 Order No. 69-7212

A model has been developed to predict average void-fraction in horizontal and vertical two-phase flow. The model is based on the assumptions that the radial distributions of liquid velocity and void-fraction can be represented by parabolic-type equations and that the local slip velocity is constant. The use of a parabolic equation for the void-fraction profile was verified with experimental void-fraction profile data from the literature. The use of a parabolic equation for the liquid velocity profile was based on data from the literature for horizontal flow and experimental data from this study for vertical flow. The assumption of a constant local slip velocity was made through a semitheoretical development in this study. This work also served as a foundation for investigations involving heat transfer or viscoelastic flows. Dissert. Abstr.

N70-18032 Catholic Univ. of America, Washington, D.C.
CONDENSATION ON VERTICAL CYLINDRICAL SURFACE FROM MIXTURES OF STEAM AND NONCONDENSABLES UNDER CONDITIONS OF NATURAL CONVECTION
Donald Frank Knuth (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-9087

An experimental study of steam condensation in the presence of noncondensable gases of helium, nitrogen, and carbon dioxide was made at pressures of 10 and 40 psig. The measurements were made on a vertical cylindrical surface under conditions of natural convection in the vapor-gas region. The calculated and measured concentration profiles showed steep concentration gradients near the condensing surface. Nearly the entire change in gas concentration was found to occur within a few tenths of an inch normal to the surface, and the change from this point to infinity was small. Calculated condensation rates as a function of gas concentration at infinity were compared to measured values at 0.7 inches from the surface and found to be in fair agreement. Dissert. Abstr.

N70-18049*# ARO, Inc., Arnold Air Force Station, Tenn.
EFFECTS OF MASS TRANSFER AND CHEMICAL NONEQUILIBRIUM ON SLENDER BLUNTED CONE PRESSURE AND HEAT-TRANSFER DISTRIBUTIONS AT M = 13.2 Final Report, 1 Mar. – 15 Jul. 1968
Clark H. Lewis, J. C. Adams, and G. E. Gilley Dec. 1968 96 p refs Submitted for publication
(NASA Order A-1369A; Contract F40600-69-C-0001; ARO Proj. VW1876)
(NASA-CR-107899; AD-680395; AEDC-TR-68-214) Avail: CFSTI CSCL 20D

The effects on the pressure and heat-transfer distributions of injecting helium and argon into an air laminar boundary layer over a spherically blunted 7.5-deg half-angle cone at M = 13.2 and $Re/in. = 1520$ were considered. Calculations are presented for a binary perfect gas boundary layer including transverse curvature and displacement effects, an ionizing air nonequilibrium boundary layer without higher-order effects, and a nonequilibrium stagnation point thin viscous shock layer model. The effects of inviscid chemical equilibrium and nonequilibrium external conditions and wall catalyticity were investigated. Neglecting all higher-order effects,

comparison of binary gas and ionizing air boundary-layer results showed reasonable agreement. Strong effects of inviscid chemical nonequilibrium on stagnation point heat transfer were found. Arguments are given for using inviscid nonequilibrium stagnation conditions rather than the usual chemical equilibrium conditions for nonequilibrium boundary-layer calculations. Author (TAB)

N70-18055# National Engineering Lab., Glasgow (Scotland). Applied Heat Transfer Div.
CALCULATION OF 'CHOKING' FLOWRATES DURING STEAM-WATER FLOW THROUGH PIPES
D. Chisholm Dec. 1968 10 p refs
(NEL-377) Copyright. Avail: CFSTI

Choking flow can occur in boilers during blow down and other processes, but convenient methods of estimating flowrates under these conditions are not generally available. A relatively simple method is outlined and compared it with experiment for conditions ranging from 'all steam' to 0.1 per cent dryness, and for pressures from 0.02 MN/ m2 (3 lb/in2 abs.) to 2 MN/m2 (300 lb/in2 abs.). Predicted and experimental values can be as much as ten times as large as values predicted by homogeneous theory. Author

N70-18058 Pittsburgh Univ., Pa.
STOCHASTIC MODEL STUDY OF DIFFUSION OF SOLID PARTICLES
Kuang-Chian Chen (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-6394

A stochastic model of the motion of solid particles suspended in a three-dimensional turbulent flow is presented. A corner region of a straight rectangular channel, in which the semiempirical method of calculating secondary velocities is valid, is used as a device to generate the three-dimensional flow. The developed stochastic model consists of the random and deterministic components. The random component represents the random walk of the particles at the presence of the fluid turbulence. The deterministic component represents the transport of solid particles due to the gravity force and primary and secondary flows. An analytical method was developed to determine the magnitude of the random vector of the random motion and the time interval between each consecutive step of the random walk. The developed stochastic model is then applied to the study of an unsteady three-dimensional diffusion problem by the Monte Carlo method. Dissert. Abstr.

N70-18069 Michigan State Univ., East Lansing.
THERMAL RADIATION AND MAGNETIC FIELD EFFECTS ON THE FLOW VARIABLES NEAR A STAGNATION POINT
Wendelin Schmidt (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-5942

The equations connecting the flow variables with the geometric parameters of the streamlines in three dimensional, inviscid, and viscous radiation magnetohydrodynamic gas flow were derived. A simplified mathematical model governing the flow variables distribution near a stagnation point in radiation magnetohydrodynamic flow was developed and used to estimate the combined effects of various physical phenomena. Specifically, the combined effects of thermal radiation, magnetic field, viscosity, heat conductivity, and compressibility on the temperature, pressure, electron density, and electric conductivity distribution near a stagnation point were considered. The first order results obtained from the numerical solutions of the governing equations indicated that the effects of thermal radiation, magnetic field, and compressibility on the flow field variables are considerable, whereas the effects of viscosity and heat conductivity are very small. Dissert. Abstr.

N70-18078 Rensselaer Polytechnic Inst., Troy, N.Y.
FREE SURFACE INSTABILITY OF A ROTATING LIQUID FILM OF A SECOND-ORDER FLUID
Shoi-Yean Hwang (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-6463

The present investigation is concerned with the free surface instability of a rotating liquid film of an incompressible second-order fluid. The liquid film is attached to the outer face of an infinitely long circular cylinder which rotates with a constant angular velocity. In the absence of gravity, the primary flow field under consideration is that representing a rigid body rotation. Within the framework of the linear theory of hydrodynamic stability, the eigenvalue problem governing the instability of the primary flow, subjected to rotationally symmetric, infinitesimal disturbances, is derived. The effect of gravity is taken into account locally near the crown of the cylinder, the region of primary interest in this investigation. The case of the surface wave mode is examined in detail: in particular, the maximum growth rate of the disturbances is determined. The shear wave mode is qualitatively discussed. Dissert. Abstr.

N70-18091 Washington Univ., Seattle.
A GENERAL FIRST-ORDER THEORY FOR CALCULATING TURBULENT FLOW FIELDS
Samuel Joseph Cowan (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-7040

To demonstrate the theory, equations were applied to fully developed two-dimensional channel flow. The spectrum function equations were reduced to a coupled set of ordinary differential equations. The solution of this set was considered and it was found that there is a nonholonomic constraint on the coordinates of the transformed space. An approximate solution was obtained by assuming that the spectrum function tensor is symmetric and that the two spectrum function vectors are equal. The differential equations were solved and the Fourier transforms inverted to give the components of the stress tensor and the pressure-velocity correlation vector. The mean momentum equation was solved to give the mean velocity profile in the channel. The analytical results for the stress tensor and the mean velocity profile were compared to experimental data. It was found that the analytical results agree reasonably well with experimental data for the mean velocity and the component of the stress tensor. In the cases where disagreement existed, the source of the disagreement was traced either to the neglect of the triple correlations or to assumptions made in obtaining the approximate solution. Dissert. Abstr.

N70-18119 National Aerospace Lab., Amsterdam (Netherlands).
COMPUTER PROGRAMMES IN USE AT NLR FOR THE CALCULATION OF STATIONARY SUBSONIC FLOW AROUND WING-BODY COMBINATIONS
W. Loeve 10 Nov. 1969 32 p refs Supersedes NLR-AT-69-02 (NLR-AT-69-02; NLR-AT-69-12) Avail: CFSTI

Some information is presented concerning the calculation of flow details around wing-body combinations. Attention is paid to such items as computer programme capability, running time and comparison of results of two methods with exact solutions of potential theory or experiments. Author

N70-18123 Texas A&M Univ., College Station.
CHARACTERISTICS OF GRAVITY WAVES OF PERMANENT FORM
Joseph John von Schwind (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-5160

In the classical problem of two-dimensional gravity waves of permanent form over a horizontal sea bed, one seeks a velocity potential and/or a stream function which satisfies Laplace's equation plus certain boundary conditions and symmetry conditions. Although the velocity potential satisfies a linear condition at the sea bed and in the interior of the fluid, it has a highly non-linear boundary condition imposed at the sea surface. In this work the surface boundary condition is expressed in non-dimensional form in terms of the above representation. An iterative procedure which requires a simple harmonic analysis at each step is employed to obtain

successive approximations of the coefficients entering into the unknown cyclic functions. This set of coefficients is calculated for 62 sets of assumed initial wave conditions through an iterative numerical process. The output of this process is compared with results obtained from Stokes' first, third, and fifth order theory by previous investigators. Dissert. Abstr.

N70-18130# Purdue Univ., Lafayette, Ind.
BUBBLE TO DENSE PHASE HEAT TRANSFER IN FLUIDIZED BEDS
Kent Alan Williams (M.S. Thesis) Jan. 1970 108 p refs
Avail: CFSTI

According to the two phase model for fluidization, gas flow above the minimum rate required to fluidize the bed goes through the bed as bubbles. At high bubble to dense phase superficial velocity ratios the volume of bed occupied by bubbles will be very large and any heat transfer or mass transfer occurring in the bed will be governed by the role played by bubbles. Bubble-to-dense phase heat transfer in a fluidized bed has been measured and a model has been developed which interprets the data in terms of the heat exchange coefficient. For a continuous chain of cold bubbles injected from a single orifice into a warm-air incipiently fluidized bed, the larger particles gave the greater values. Reinterpretation of some previous classical gas-to-particle heat transfer measurements based on plug flow exhibit good agreement. Author

N70-18134 Michigan State Univ., East Lansing.
SOME GEOMETRIC PROPERTIES OF COMPRESSIBLE FLUID FLOWS AND CERTAIN CLASSES OF SUCH FLOWS OBTAINED BY INTRINSIC METHODS
Lester Byron Fuller (Ph.D. Thesis) 1968 55 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-5866

Steady nonviscous nonheat-conducting flow of a compressible fluid in the absence of external forces is discussed in this paper. In particular the geometry of such flows is studied, the dynamical equations which characterize these flows are reformulated, and some classes of flow are obtained. In connection with the geometry, a condition is obtained which is necessary and sufficient for the existence of stream surfaces that contain the vortex lines. These are called Lamb surfaces. Then, two necessary and sufficient conditions are found; one for streamlines to be geodesics on Lamb surfaces and the other for streamlines to be asymptotics on stream surfaces. Dissert. Abstr.

N70-18145# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
INTERACTION OF FLUID MOTION Final Scientific Report, 1 Jan. – 31 Dec. 1968
William O. Criminale, Jr. 31 Dec. 1968 15 p refs
(Contract AF 49(638)-1656)
(AD-696214; AFOSR-69-2656TR) Avail: CFSTI CSCL 20/4

Certain complex fluid flows were analysed and explored by means of decomposition of the phenomena into simpler elements and sythesizing the results into workable models. The specific problem areas where this technique was employed with success are: (1) Formation and development of wakes behind a thin flat plate or airfoil (2) interaction of flat plate laminar boundary layers with free-stream turbulence (3) flow of heterogeneous fluid systems (4) response of a fully turbulent flow to external influences. The status of each of these topics is discussed. In addition, several related outputs which have come about because of the findings in the direct explorations are mentioned. A chronological bibliography of papers, seminars, and reports which have been completed or are in preparation is listed. Author (TAB)

N70-18160# Bureau of Mines, Morgantown, W. Va.
FLUID FLOW IN CHANNELS, CAPILLARIES, AND POROUS MEDIA UNDER THE INFLUENCE OF AN ELECTRIC FIELD
L. C. Headley, C. I. Pierce, and W. K. Sawyer Jan. 1970 40 p refs
(BM-RI-7342) Avail: CFSTI

A series of exploratory tests was conducted to determine the effects of steady electric fields on fluid flow and streaming potential in narrow passages and porous media, the effects of steady electric fields on fluid interfaces, and the influence of internal voltages of fluid flow in a porous porcelain sample. Voltages greater than about 5 kilovolts were found to influence liquid droplets emanating from a capillary tube. Solutions of polyethylene oxide and polyacrylamide in water exhibited widely different behavior than that of other liquids tested. Liquid-liquid displacement tests in porous samples to determine the influence of high voltage applied to the displacing liquid on flow rates and recovery gave no significant differences. No consistently measurable effects were noted, either on flow rate or streaming potential, when an electric field was applied transverse to the direction of flow in porous media and in narrow rectangular or cylindrical channels. Experimental values of formation factor and streaming potential for a porous porcelain sample agreed qualitatively with those calculated from electrokinetic theory for ultrafine capillaries. However, the agreement for the electro viscous effect was not good. Author

N70-18175 Rensselaer Polytechnic Inst., Troy, N.Y.
STABILITY OF SPATIALLY PERIODIC SUPERCRITICAL FLOWS IN HYDRODYNAMICS
Stanley Kogelman (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-6466

Eckhaus' theory is generalized and used for a class of systems of partial differential equations with quadratic nonlinearities. The functions involved are assumed to depend on two spatial variables as well as time. The equations governing axisymmetric viscous flow between concentric rotating cylinders belong to the class of equations considered. When the Taylor number is slightly above the minimum critical value there exists an interval of possible equilibrium flows (Taylor-vortex flows) growing out of the instability of laminar circular Couette flow. It is shown that within the interval of possible Taylor-vortex flows, there exists a subinterval of stable vortex flows. By expanding the solution in terms of appropriate small parameters, it was shown that Reynolds and Potter's results and the results of the Stuart-Watson approach are exactly the same to the order of accuracy of the computations. Further, it was shown that the arbitrariness does not affect the solution (to the order of accuracy of the computations) as long as certain compatibility conditions are satisfied. Dissert. Abstr.

N70-18177# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE STABILITY OF FLOW INDUCED BY A ROTATING CYLINDER IN A STRATIFIED FLUID
John V. Droughton and C. F. Chen Oct. 1969 45 p refs
(Grants NSF GK-1269; NSF GK-2096)
(RU-TR-131-MAE-F) Avail: CFSTI

The effect of a constant density gradient on the stability of the time-dependent flow induced by an impulsively started cylinder with horizontal axis of rotation was experimentally investigated along with the effect of the instabilities on the flow far from the cylinder. It was observed that the density gradient serves to inhibit the formation of the Taylor instabilities and alters their shape for circular to ellpitcal. A strong Richardson number dependence for stability was exhibited in stratified fluids. The axial spacing of the instabilities was not observed to be affected by the presence of a density gradient. The presence of the instabilities in the vicinity of the rotating shaft appeared to cause the fluid in the region far away from the cylinder to alter its basic motion. Two distinct regions of horizontal far-field flow were observed, separated by a smooth transition region. This transitional effect exhibited strong Richardson number dependence. Author

N70-18179 Washington Univ., Seattle.
A STUDY OF AXIALLY-SYMMETRIC SUBSONIC BASE FLOW
Robert Gerlad Van Wagenen, Jr. (Ph.D. Thesis) 1968 282 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 69-7085

An investigation was conducted of axially-symmetric subsonic flow past a long bluff-based cylinder whose axis was aligned with the primary direction of the free stream flow. Experimental studies were conducted using a three-inch diameter cylinder placed in air streams at velocities of 87 and 130 feet per second. Results were obtained for a range of boundary layer thicknesses as measured at the base corner. Studies were limited to cases of constant cylinder geometry with no mass or heat addition into the base region. A primary objective of this work was to provide experimental information to describe the mixing region behind a blunt-based cylinder in low-speed axially-symmetric flow. This information has been provided in the form of hot-wire mean velocity and turbulence profiles (axial direction), flow field streamsurface traces and flow field static pressure contours, for two turbulent boundary layer thicknesses at each of the given air flow velocities. Dissert. Abstr.

N70-18229 Carnegie-Mellon Univ., Pittsburgh, Pa.
ENTRANCE AND EQUILIBRIUM FLOW OF VISCOELASTIC FLUIDS THROUGH A CYLINDRICAL TUBE
Nicholas Dominic Sylvester (Ph.D. Thesis) 1968 305 p
Avail: Univ. Microfilms: HC $13.75/Microfilm $3.95 Order No. 69-6588

Laminar flow of viscoelastic fluids into and through cylindrical tubes was studied. The use of radial pressure measurements in fully developed laminar flow to determine normal stress differences was evaluated, and entrance pressure drop measurements were made to demonstrate quantitatively the existence of the elastic contribution. A closed-loop flow system, which consisted of an eight foot long, horizontal, transparent plastic test section equipped with a series of pressure taps and manometers to measure differential pressure drops and other auxiliary equipment, was used to provide axial pressure profiles, paying particular attention to the entrance and exit regions. Experimental data were obtained for a variety of Newtonian (glycerol) and nonNewtonian (aqueous solutions of polyethylene oxide), carboxy-methyl cellulose (CMC), and polyacrylamide fluids. The power-law model adequately represented the shear stress-shear rate behavior of all the solutions tested for shear rates from 15 to 3400 (1/sec.). Dissert. Abstr.

N70-18244*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL PRESTON TUBE AND LAW-OF-THE-WALL STUDY OF TURBULENT SKIN FRICTION ON AXISYMMETRIC BODIES AT SUPERSONIC SPEEDS
Jerry M. Allen Washington Feb. 1970 29 p refs
(NASA-TN-D-5660; L-6686) Avail: CFSTI CSCL 20D

An experimental Preston tube study has been conducted in the turbulent boundary layer of a Haack-Adams body of revolution with a fineness ratio of 10 at free stream Mach numbers of 2.50 to 4.50 and a free stream Reynolds number, based on body length, of 9.15 × 10 to the 6th power. The agreement between the Preston tube measurements and theoretical calculations of skin friction is good at the lower Mach numbers but becomes progressively worse at the higher Mach numbers. Integration of the Preston tube skin friction distributions over the body surface resulted in average skin friction coefficients which were, at all Mach numbers, considerably below the values obtained from the difference between measured total drag and wave drag. Law-of-the-wall skin friction values were obtained from velocity profiles taken on the same Haack-Adams body and from profiles given in literature on a parabolic-arc body of revolution and two slender cones. The skin friction results were similar to those obtained from the Preston tube surveys at comparable Mach numbers; that is, the results show good agreement with theory over the rearward part of the bodies but become higher than theory as the nose of the body is approached. Author

N70-18252*# Applied Theory, Santa Monica, Calif.
NUMERICAL CALCULATIONS OF VISCOUS COMPRESSIBLE FLUID FLOW OVER A FLAT PLATE AND STEP GEOMETRY
John G. Trulio, Leonard Walitt, and William J. Niles Washington NASA Feb. 1970 75 p refs
(Contract NAS8-11400)
(NASA-CR-1466) Avail: CFSTI CSCL 20D

Tests were conducted to determine the feasibility of using AFTON 2A and 2P codes to compute supersonic and turbulent flow fields and to determine the accuracy of the 2P code numerical methods in calculating subsonic laminar boundary layer flow over a flat plate. Results indicate: (1) Laminar boundary layer profiles agree well with exact solutions for subsonic flow over a flat plate. (2) Laminar flows can be calculated numerically even when finite difference cells of large aspect ratio are employed. (3) Shocks may be included in some viscous compressible supersonic flow problems without the need for an artificial viscosity. (4) A turbulent boundary layer on a flat plate cannot be calculated using the AFTON 2P code unless a set of mesh points denser than that used in the tests is employed. (5) Calculations of flow over a trip in a narrow duct provides strong evidence that the numerical methods in the AFTON 2P code are capable of yielding a quantitative account of turbulent flow. D.L.G.

N70-18267 Rensselaer Polytechnic Inst., Troy, N.Y.
A STUDY OF INTERFACIAL RESISTANCE TO MASS TRANSFER AT HIGH EVAPORATION RATES
Stephen Eric Ziemniak (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/ Microfilm $3.00 Order No. 69-6482

Mass transfer data for water and carbon tetrachloride were obtained in the case of cross air flow past the forward stagnation region of a cylinder and correlated against boundary layer theory in order to investigate the influence of interfacial resistance. Data obtained with carbon tetrachloride, a liquid known to exhibit minimal interfacial resistance, indicated the same agreement (or disagreement) with theory as those obtained with water. From this it was concluded that the correction due to interfacial resistance for water during mass transfer experiments is not appreciable enough to affect the validity of the vapor-liquid equilibrium assumption at the interface. Accurate values for the evaporation coefficient could not be established, although the results indicated a high value in agreement with the current literature. Dissert. Abstr.

N70-18293# Aix-Marseilles Univ (France). Inst. de Mecanique des Fluides.
EXPERIMENTAL STUDY OF NEAR WAKES OF A CIRCULAR CONE PLACED IN INCIDENCE AT MACH 7 HYPERSONIC FLOW
J. Marcillat 30 Jun. 1969 51 p refs In FRENCH
Avail: CFSTI

Hypersonic wind tunnel tests of static pressure and temperature gradients were made at 0, 5, and 15 degrees angle of incidence to determine the aerodyanmic characteristics of symmetrical flow in a circular cone. The effect of the angle of incidence and the value of the Reynolds number were determined. Transverse profiles of temperature limits were also obtained. Results are given in graphical form. Transl. by J.M.C.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-16917 National Lending Library for Science and Technology, Boston Spa (England).
ON THE PROBLEM OF THE INFLUENCE OF OROGRAPHY AND FRICTION IN THE BOUNDARY LAYER ON VERTICAL CURRENTS IN THE FREE ATMOSPHERE
A. A. Kiselev 20 Jul. 1969 22 p refs Transl. into ENGLISH from ALMA-ATA, Kazah. Nauch.-Issled. Gidromet. Inst., T., vyp. (Russia), no. 29, 1967 p 118–126 In RUSSIAN and ENGLISH
(NLL-M-7789-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

A solution for the vertical velocity in the free atmosphere which is due to friction in the boundary layer and orography is given. The solution is distinguished by the face that the lower boundary condition is expressed with the aid of expansions in Taylor series for variable level. An estimate of the accuracy of the proposed solution is given. Author

N70-16920 National Lending Library for Science and Technology, Boston Spa (England).
ON THE ROLE OF THE GENERAL CIRCULATION OF THE ATMOSPHERE IN THE FORMATION OF THE BACKGROUND CONDITIONS FOR MUD-FLOW ACTIVITY IN S.E. KAZAHSTAN
I. P. Fadeeva [1969] 14 p refs Transl. into ENGLISH from Alma-Ata, Kazahskij Nauc.-Issled. Gidromet. Inst., Tr. Vyp. 29 (Russian), 1967 p 19–25
(NLL-M-7761-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Some preliminary results of investigations into the influence of large-scale atmospheric circulation processes on the formation of background conditions favourable for mud-flow activity in the mountain regions of S.E. Kazahstan are presented. Author

N70-16951# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 218
10 Dec. 1969 73 p Transl. into ENGLISH from Russian publs.
(JPRS-49410) Avail: CFSTI

CONTENTS:
1. ASTRONOMY p 1–5 refs (See N70-16952 06-30)
2. METEOROLOGY p 6–21 refs (See N70-16953 06-20)
3. OCEANOGRAPHY p 22–28 refs (See N70-16954 06-13)
4. TERRESTRIAL GEOPHYSICS p 29–39 refs (See N70-16955 06-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 40–54 refs (See N70-16956 06-13)

N70-16954# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 218 10 Dec. 1969 p 22–28 refs (See N70-16951 06-13)
Avail: CFSTI

The classification of world ocean water into surface, intermediate, and deep water masses is briefly discussed. Marine biological structure and electric field variations, and the velocity field in surface waves are described. Data on trophic plankton in the frontal zones of the Indian Ocean, and the nature of feading of abyssal copepods are given. Research ship voyages and ocean drilling are mentioned. N.E.N.

N70-16955# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. In Geophys., Astronomy, and Space, No. 218 10 Dec. 1969 p 29–39 refs (See N70-16951 06-13)
Avail: CFSTI

Results of seismic, magnetic, and electrical soundings of the earth are reviewed. The lower boundary of ferromagnetism in the crust, electric conductivity in the crust, and the use of hydromagnetic surveys in studying the oceanic crust were investigated. Magnetic variation sounding in the upper mantle at low latitudes, and seismic sounding of the mantle surface under the oceans are described. A deep fault in the crustal structure was noted in eastern Soviet, and the gravitational field of Angara–Lena interfluve was determined. Rock temperature measurements in superdeep boreholes are reported, along with a geological study of the Baltic area for petroleum exploration. The effects of the Tashkent earthquake of 26 April 1966 on buildings and Turkmen seismic service are mentioned. N.E.N.

N70-16956# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. In Geophys., Astronomy, and Space, No. 218 10 Dec. 1969 p 40–54 refs (See N70-16951 06-13)
Avail: CFSTI

Abstracts of journal articles on the physics of the atmosphere, spacecraft, and the moon are presented. Scattering and absorption of radio waves by the ionosphere, magnetospheric and ionospheric models, and the polarization of auroral radio reflections are discussed briefly. Methods of determining atmospheric density and the altitudes of virtual relection are outlined. Meteor trail drifts, terrestrial analogs of lunar rocks, and lunar neutron radiation induced by cosmic radiation are described. Studies on spacecraft control, motion, engine optimization, reentry, and trajectory optimization are reviewed, and the launchings of Cosmos 308, 309, and 310 are announced. N.E.N.

N70-16958# Army Foreign Science and Technology Center, Washington, D.C.
GEOGRAPHIC CORRELATIONS IN DISTANT EXTRAPOLATION OF INTERPRETATION CHARACTERISTICS OF LANDSCAPE ANALOGS
B. V. Vinogradov 4 Nov. 1969 59 p refs Transl. into ENGLISH from Primenenie Aerometodov Dlya Izuch. Gruntovykhvod, (Russian), N. P., 1962 p 114, 143
(AD-696915; FSTC-HT-23-740-68) Avail: CFSTI CSCL 8/7

Distant extrapolation of interpretation characteristics is determined primarily by geographic correlations and is conducted along basic geographic zones and within the limits of zone it is conducted by landscape analogs. Interpretation characteristics developed on key sections can be extrapolated for landscape analogs. Interpretation characteristics developed on key sections can be extrapolated for landscape analogs in the USSR and foreign countries. Author (TAB)

N70-16959# Air Force Cambridge Research Labs., Bedford, Mass.
THE VARIATION OF THE UPPER ATMOSPHERIC SCALE HEIGHT AND ITS EFFECT ON ATMOSPHERIC TIDAL WAVELENGTHS Environmental Research Papers
William J. Taffe Aug. 1969 25 p refs
(AD-696095; AFCRL-ERP-304; AFCRL-69-0350) Avail: CFSTI CSCL 4/1

Using atmospheric models from the U. S. Standard Atmosphere 1966, Supplements, the extremes of the atmospheric scale height profile are obtained and compared with an average profile. The first and second height derivatives of all three profiles are calculated and compared. An expression is obtained for the wavelength of the atmospheric tide (a function of the scale height and its derivatives) which is more exact than the one in common use, and the extent of validity of the approximate formula is shown. The change in the tidal wavelength due to variation of the scale height profile is also explicated. Author (TAB)

N70-16999*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SEASONAL VARIATIONS IN THE F2 REGION
H. G. Mayr and K. Mahajan Jun. 1969 33 p refs
(NASA-TM-X-63793; X-621-69-255) Avail: CFSTI CSCL 04A

Semiannual and annual variations in the F sub 2-region are discussed based on critical frequency and radar backscatter observations during the descending phase of solar activity (1958 – 1965). The semiannual effect appears as a persistent feature of the ionosphere which, demonstrably, is not related to fluctuations in the 10.7 cm noise or the EUV radiation. This gives support to theories that attribute the semiannual effect to variations in the lower atmosphere. The annual variation in the ionosphere, showing a winter to summer enhancement in the F sub 2 peak density at low latitudes and during low solar activity, can be explained by meridional winds at ionospheric heights. These winds also have a significant effect on the height of the F sub 2 peak and appear to be effective throughout the solar cycle as evident from radar backscatter observations, which show the peak at higher altitudes in summer than winter. Author

N70-17008# Environmental Technical Applications Center (Air Force), Washington, D.C.
A SELECTED ANNOTATED BIBLIOGRAPHY ON LIGHTNING (1964 – 1969)
Alvin L. Smith, Jr. and Dennis L. Boyer Nov. 1969 49 p refs
(AD-697020; ETAC-TN-69-8) Avail: CFSTI CSCL 4/1

The bibliography contains 126 annotated references concerning lightning, generally as it occurs in the atmosphere. A subject index is included showing the numbered items pertaining to each subject breakdown. A number of pertinent textbooks are given in a separate listing. Author (TAB)

N70-17043*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVIDENCE FOR STRONGLY DAMPED GRAVITY WAVES IN THE EARTH'S ATMOSPHERE
Igor J. Eberstein Dec. 1969 42 p refs Submitted for publication
(NASA-TM-X-63795; X-621-69-545) Avail: CFSTI CSCL 04A

Data from a series of pitot tube rocket soundings of the atmosphere are examined. Temperature data from four soundings, carried out over a two day period, were averaged, and a smooth curve was drawn through the points. A hydrostatically determined atmosphere based on the above lapse rate was calculated. Deviations from the above mean atmosphere were calculated, and a wavelike structure was observed. The waves grow very slowly below approximately 80 km, and acquire a more rapid growth rate at higher altitudes. The density and temperature variations have a wavelength of 10 – 20 km and appear to consistently be about 180 degrees out of phase. The pressure variation is somewhat irregular. However, in regions where pressure variation is well behaved it is out of phase with temperature and density by about 90 degrees. Volland's theory of thermally damped gravity waves was used to compute wave patterns like those observed experimentally. A highly damped, upward propagating wave gives good results. Damping by conduction, turbulence and radiative transfer is examined, and turbulence is found to be the most important. Author

N70-17048# International Business Machines Corp., Cambridge, Mass. Advanced Systems Dept.
AUTOMATIC COMPUTATION OF ATMOSPHERIC DENSITIES Final Report, Sep. 1967 – Sep. 1969
Arnold S. Bramson, Richard A. Le Schack, and Jack W. Slowey Nov. 1969 90 p refs
(Contract F19628-68-C-0032)
(AD-697087; AFCRL-69-0443) Avail: CFSTI CSCL 4/1

The Cambridge Atmospheric Density Numerical Integration Program (CADNIP) is a completely automatic computer program capable of determining atmospheric densities from an analysis of satellite observations. The adopted approach consists of a numerical integration procedure combined with a differential correction scheme where discrepancies between computed and observed satellite position and velocity are reconciled by adjusting the assumed atmospheric model, thereby yielding corrected or refined density data. This report documents the latest version of the program which includes significant refinements and improvements incorporated into CADNIP. Author (TAB)

N70-17080# Stanford Research Inst., Menlo Park, Calif.
SCIENTIFIC IMPACTS OF PHENOMENA-ORIENTED RESEARCH SPONSORED BY AFOSR
James E. Hacke, Jr. 15 Aug. 1969 45 p refs
(Contract F44620-68-C-0029)
(AD-697044; AFOSR-69-2864TR) Avail: CFSTI CSCL 17/2.1

This exploratory study has the purpose of developing and demonstrating methods of evaluating the scientific impacts of pioneering phenomena-oriented research sponsored by a mission-oriented agency. Whistlers are audio-frequency radio signals resulting from the longitudinal propagation of sferics in the exosphere. Their general characteristics were fairly well understood prior to 1960; but work sponsored by AFOSR in that year contributed materially positive identification of their sources, understanding of the laws of their propagation, and elicitation of the information they yield about electron and proton concentrations at altitudes of up to 4 earth radii. As verified by other means, notably radio satellites, this information plays a pivotal role in understanding the exosphere, the radiation belts, the magnetosphere, and the limitations to earth-based radiolocation. Author (TAB)

N70-17107# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ATMOSPHERIC DENSITY ABOVE 158 km INFERRED FROM MAGNETRON AND DRAG DATA FROM THE SATELLITE OV1-15(1968-059A) Research Report, Jul. 1967 – May 1969
Virginia L. Carter, Barbara K. Ching, and David D. Elliott 15 Jul. 1969 35 p refs
(Contract F04701-69-C-0066)
(AD-697030; TR-0066(5260-10)-1; TR-0200(4260-10)-1; SAMSO-TR-69-345) Avail: CFSTI CSCL 4/1

A cold-cathode magnetron pressure gauge and a C-band radar beacon were part of the complement of experiments aboard the polar-orbiting atmospheric research satellite OV1-15 (1968-059A). Over the period 13-15 July 1968, when the perigee of the satellite was near the equator at about local noon, the atmospheric density profiles were repeatedly measured down to 158 km. The profiles agreed in the northern and southern hemispheres below 200 km, but above 200 km the northern profile was greater than the southern, in approximate agreement with the Jacchia model that includes a symmetric density bulge at the subsolar latitude at 1400 hr local time. During a moderate magnetic disturbance, the atmospheric density at latitudes below about 40 degrees increased with an amplitude and lag that are adequately described by the Jacchia model, except that the duration of the density enhancement was several hours longer than the duration of the geomagnetic disturbance. Author (TAB)

N70-17108# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
THE EFFECTS OF THERMAL POLLUTION ON RIVER ICE CONDITIONS. PART 2: A SIMPLIFIED METHOD OF CALCULATION Research Report
S. Lawrence Dingman and Andrew Assur Aug. 1969 16 p refs
(AD-694372; CRREL-RR-206-Pt-2) Avail: CFSTI CSCL 8/8

The paper describes a simplified approach to a method for calculating the temperature profile of a cooling river below a source of thermal pollution and the length of ice-free reach which could be maintained by such a source. Heat loss is calculated as a linear function of the difference between water temperature and air temperature, so that the integration can be performed analytically. A simplified but fairly general procedure for calculating water-surface heat-loss rates on the basis of air temperature, windspeed, solar radiation, and general atmospheric conditions is also presented. Author (TAB)

N70-17109*# GCA Technology Div., GCA Corp., Bedford, Mass.
RESEARCH DIRECTED TOWARD DEFINING THE VARIABILITY OF THE ATMOSPHERE BETWEEN 30 AND 200 KILOMETERS Interim Scientific Report
E. D. Schultz Sep. 1969 90 p refs
(Contract NAS12-617)
(NASA-CR-86314; GCA-TR-69-11-N) Avail: CFSTI CSCL 04A

Up-dating and analysis of data from rocket and optical probe soundings of the upper atmosphere is reported. A discussion of Soviet rocket soundings is included. A computer program was written and run which reprocessed and transferred the original data collection of 442 soundings from IBM cards to magnetic tape into standard format. The program also performs monotonicity tests on the density-altitude profiles of the soundings. Additional analyses have been performed with respect to certain thermistor temperature data corrections and improvements in the analysis of the correlation between atmospheric density and solar flux data. Author

N70-17110*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROVISIONAL HOURLY VALUES OF EQUATORIAL Dst FOR 1968
M. Sugiura and S. J. Cain Jan. 1970 21 p refs Submitted for publication
(NASA-TM-X-63796; X-612-70-3) Avail: CFSTI CSCL 08N

Observations from Hermanus, Honolulu, and San Juan are tabulated. Computed hourly values of equatorial Dst are presented in graphic and tabular form. Daily and monthly mean Dst values are included. D.L.G.

N70-17145# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
STUDIES IN MARINE GEOPHYSICS AND UNDERWATER SOUND FROM DRIFTING ICE STATIONS Final Report
Kenneth L. Hunkins, Henry W. Kutschale, and John K. Hall Sep. 1969 109 p refs
(Contract Nonr-266(82))
(AD-696997) Avail: CFSTI CSCL 8/12

The detailed drift of T-3 from May 1962 to June 1969 is plotted from over 9000 celestial and satellite fixes processed entirely by digital computer. Over 14,000 km of precision depth profiles show detailed topography of parts of the Northwind Ridge, Chuckchi Rise, Mendeleyev Ridge, Alpha Cordillera, Wrangel Plain, Canada Plain, and Chuckchi Plain. Over 4,500 km of continuous seismic reflection profile show sediment thicknesses of about 1 km on the ridges to more than 3.5 km under Wrangel Plain. Over 49,000 magnetic and 10,000 gravity measurements have helped to delineate regional geologic structure and crustal movements. The sound scattering layer in the Arctic was discovered on precision depth recordings. Long-range sound propagation in the Arctic SOFAR channel is described by ray and normal mode theory. The normal mode treatment for the channel bounded above by a rough ice sheet is in remarkably good agreement with acoustic signatures from distant explosions. The Ekman current spiral was verified. This is the first quantitative verification of Ekmans theory in any deep ocean. The first observations of seismic noise on the Arctic Ocean floor were made aboard ice island ARLIS II. Author (TAB)

N70-17148# Florida Univ., Gainesville. Communication Sciences Lab.
MAN'S PERFORMANCE IN THE SEA SEMINAR
Harry Hollien, John Brandt, and Donald Dew 15 Sep. 1969 12 p
(Grant Nonr 580(20))
(AD-696124; CSL-ONR-26) Avail: CFSTI CSCL 8/10

A Seminar was conducted in order to inform and stimulate young workers of high research potential with respect to appropriate research concepts, design and methodology - and current oceanographic projects. The focus of the seminar was on mans performance in the sea and it was developed with respect to five major areas of underwater research: perception, physiology, work performance, communication and habitats. The document is comprised of a list of participants and the seminar schedule. Author (TAB)

N70-17278# Army Foreign Science and Technology Center, Washington, D.C.
SOME CHARACTERISTICS OF VERTICAL VARIABILITY OF THE WIND VELOCITIES IN THE ATMOSPHERIC BOUNDARY LAYER
P. A. Pershina 23 Oct. 1969 12 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Inst. Aeroklimatologii (USSR), no. 52, 1968 p 93-97
(AD-696918; FSTC-HT-23-013-70) Avail: CFSTI CSCL 4/1

The climatology of the boundary is still very poorly developed because research in this field has really only begun. For this reason it is not without interest to give an analysis of some characteristics of the vertical variability of wind velocity based on an analysis of empirical data. The analysis was based on data from rawin sounding at aerological stations in the USSR Kiev, Leningrad, L'vov, Minsk, Moscow, and Riga during the period from 1959 through 1963. These data were used in computing the mean and mean square deviations of wind velocity from the vane both for altitudes 0.1, 0.2, and 0.5 km above the ground surface and for 1.0, 1.5, 2.0, and 3.0 km above sea level. In the computations it was taken into account that for a number of k in the case of lack of data for the mentioned level data for the remaining levels are excluded during analysis. Author (TAB)

N70-17283# Illinois Univ., Urbana. Ionosphere Radio Lab.
STUDIES OF THE INOSPHERE AT GEOMAGNETICALLY CONJUGATE STATIONS Final Technical Report, 1 Aug. 1968 - 31 Aug. 1969
Kung C. Yeh, Bernard J. Flaherty, and Han R. Cho Sep. 1969 131 p refs
(Contract F19628-67-C-0028)
(AD-697055; AFCRL-69-0419; TR-37) Avail: CFSTI CSCL 4/1

The report consists of three parts. The first part describes a polarimeter system that has been developed and used to measure polarization of signals from geostationary satellites. Circuit diagrams and sample data are given. The system is a modification of a system described by Titheridge. The second part describes the Cold Bay operation. Electron content data have been scaled and processed for the period December 25, 1968, through April 30, 1969. When compared with Urbana, Cold Bay shows very flat content curves at winter night, very few pre-sunrise dips and wave-trains in electron content with periods varying from three to five minutes in addition to normal travelling disturbances. The day-to-day change in electron content is found to be anti-correlated at geomagnetically conjugate stations during magnetic quiet days and to be correlated during magnetic disturbances. The third part describes some theoretical work. Several other effects such as the magnetic declination effect and the effect of a dynamo electric field have been studied. Author (TAB)

N70-17284# RAND Corp., Santa Monica, Calif.
ON THE UPPER AND LOWER LIMITS TO THE RYTOV APPROXIMATION
G. E. Modesitt Sep. 1969 24 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-696957; RM-6090-ARPA) Avail: CFSTI CSCL 12/1

The equation for wave propagation in a random medium cannot be solved analytically in order to estimate theoretically the amplitude and phase fluctuations of the wave, certain standard approximations--linearization of the wave equation, forward scattering assumption--have been widely adopted. The consequent restrictions on the validity of the solutions is estimated and presented in the form of lower and upper range limits. Various upper limits, the consequence of the linear approximation, have previously been obtained by other methods. These approaches are discussed and their discrepancies explained the lower limit and

the general consequences of the forward scattering assumption have not previously been noted. In particular, it is shown that, for optical propagation in the atmosphere, the lower and upper limits coincide and that the standard approximations are consequently invalid.
Author (TAB)

N70-17336# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
DEFINITION OF PROBLEMS IN PLANNING PHOTOGRAMMETRIC PROJECTS
H. G. Jerie *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 3-19 (See N70-17335 06-14)
Avail: CFSTI

Factors which influence the decisions in project planning are discussed. The first important step is identified as the translation of user requirements into technical specifications. In designing the project the environmental factors of the object or end-product and the environmental factors of the executing organization must be considered. Here, the cost and time estimate is the most important aspect. The environmental factors, and the aspects these factors and the technical specifications influence are listed. The most important phases or possible phases in the general structure of a photogrammetric project are described. These include aerial photography, signalization, terrestrial control, aerial photography, field identification and completion, cartography, and reproduction. The factors influencing accuracy, interpretation, and cost are discussed and models are developed. N.E.N.

N70-17344# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
TOPOGRAPHIC MAPPING
A. Verdin *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 138-155 (See N70-17335 06-14)
Avail: CFSTI

Maps contents and uses and mapping systems are described, distinguishing between the situations in industrial and developing countries. Base maps in industrial countries must show quantity of detail and scales from 1:5000 to 1:25,000 are used. In developing countries the need is to obtain base maps for a general view of resources, and a scale of 1:50,000 is recommended. Mapping systems in industrial countries are based on existing geodetic networks with the determination of control points taking little time. Proposals for the rapid establishment of ground control maps and for a topographic mapping system to be done in phases are described for the developing countries. The equipment needed for photointerpretation in each case and the problem of map revision in industrial countries are mentioned. N.E.N.

N70-17345# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
HIGHWAY MAPPING
A. J. van der Weele *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 156-165 (See N70-17335 06-14)
Avail: CFSTI

The use of photogrammetry and digital terrain models for highway mapping is discussed. The advantages of a digital terrain model are considered to be that only one restitution is needed and that the model can be formed by means of comparator measurements. The disadvantages are limited use in urban areas, the number of points to be measured, and dependency on large computer facilities. The types of models are identified as random distribution of points, triangular or square pattern of points, and points on characteristic terrain lines. N.E.N.

N70-17346# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
CADASTRAL AND URBAN MAPPING
J. Visser *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 166-177 (See N70-17335 06-14)
Avail: CFSTI

A method of reducing gross errors in coordinates of points for cadastral surveys is outlined, and the use of cadastral surveys for agrarian reform is described. Photogrammetric experiments using color, monochrome, and orthophotographs in urban mapping are reviewed. N.E.N.

N70-17394*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OGO 4 OBSERVATIONS OF ION COMPOSITION AND TEMPERATURES IN THE TOPSIDE IONOSPHERE
S. Chandra, B. E. Troy, Jr., J. L. Donley, and R. E. Bourdeau Jan. 1970 36 p refs
(NASA-TM-X-63805; X-615-70-1) Avail: CFSTI CSCL 04A

Direct measurement of the densities of various ionic constituents and the temperatures of ions and electrons were obtained from the OGO 4 planar retarding potential analyzer in the altitude range 400-900 km. Results are presented from day and night passes in the mid and low latitudes near the 1967 fall equinox. The passes are selected to emphasize the latitudinal rather than the height dependence of the measurements. Author

N70-17395*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DIURNAL PHASE ANOMALY IN THE UPPER ATMOSPHERIC DENSITY AND TEMPERATURE
S. Chandra and P. Stubbe (Max-Planck-Inst. fur Aeronomie, Lindau uber Northeim, West Ger.) Jan. 1970 30 p refs
(NASA-TM-X-63807; X-615-70-4) Avail: CFSTI CSCL 04A

The heat conduction equation for the neutral atmosphere in the region between 120-1500 km is solved using the concept of dynamic diffusion. It is shown that the present discrepancy in the phase and the diurnal amplitude of the thermospheric temperatures as inferred from incoherent backscatter and satellite drag measurements can be fully reconciled by such an approach. The numerical solutions show that the phase and the diurnal amplitude of the atmospheric density in the region between 200-500 km are in accord with the satellite drag results. In the region where hydrogen becomes a dominant constituent, the density reaches its maximum value in the nighttime and its minimum in the day-time. The physical basis for the dynamic diffusion is discussed, and it is suggested this should replace the conventional static diffusion models in computing temperatures from the atmospheric densities obtained from satellite drag measurements. Author

N70-17417*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRIC FIELD OBSERVATIONS OF IONOSPHERIC WHISTLERS
N. C. Maynard, T. L. Aggson, and J. P. Heppner Dec. 1969 34 p refs
(NASA-TM-X-63808; X-645-70-11) Avail: CFSTI CSCL 04A

A Nike-Tomahawk sounding rocket was launched near local noon on November 8, 1966 from Wallops Island with a triaxial electric field experiment using long cylindrical dipoles for sensors. Twenty ELF whistlers with dispersion constants ranging from .15 to .85 sec to the 1/2 power were detected and identified as having propagated up to the rocket through the E region from the earth-ionosphere waveguide. The data extend to the smallest dispersion ever encountered and the lowest frequencies observed on ionospheric whistlers (60 Hz). The waves were elliptically polarized, becoming more nearly circular at higher altitudes. Analysis showed good agreement between the experimental results and quasi-longitudinal propagation theory for amplitude, dispersion, and polarization characteristics of the wave once one is away from the D to E region boundary. No appreciable effects of negative ions or protons were observed in the dispersion of the whistlers. Author

N70-17429*# Fairchild Camera and Instrument Corp., Syosset, N.Y. Space and Defense Systems.
EARTH RESOURCES DATA PROCESSING CENTER STUDY. VOLUME 2: STUDY FINDINGS Final Report
15 Sep. 1969 308 p refs
(Contract NASw-1811)
(NASA-CR-107887; ED-AA-113) Avail: CFSTI CSCL 08G

A review is presented of the basic objectives and requirements of the major government support agencies and experimenter groups associated with the Earth Resources Program, as well as the sensor and auxiliary equipments associated with the Manned Spacecraft Center aircraft survey program. Data flow models are developed which depict the processing of typical data from each sensor class through the associated MSC ground data processing facility. Future trends in the Earth Resources Program are delineated, with emphasis on the Houston aircraft program, its eventual coordination with spacecraft collection activities, and its attendant ground data processing requirements. Priority techniques, system and facilities growth requirements are identified. Development plans are presented to permit the timely research, development, construction and test of required processing equipment and facilities. Recommendations and conclusions concerning future effort aimed at furthering the growth of the earth resources data processing facilities at the Manned Spacecraft Center are developed. Author

N70-17478# Oulu Univ. (Finland). Dept. of Electrical Engineering.
ON THE SIMULTANEOUS MEASUREMENTS OF IONOSPHERIC ELECTRON CONTENTS
J. P. Schoedel 1969 41 p refs
(Rept-S-5-1969) Avail: CFSTI

Using a model, the possibilities and limitations of simultaneous measurement of ionospheric and exospheric electron content by means of distant spacecraft are investigated. It is found that such measurements are possible but that care has to be taken if the exospheric electron content is less than 8% of the ionospheric one. Two reasons for considerable errors exist: the calibration methods for the electron content are not satisfactory and the height of the ionospheric point has to be determined carefully. Regarding the latter, it is recommended that the mean ionospheric height should be determined experimentally. The method is described in detail and a numerical estimate is given together with an example. Author (ESRO)

N70-17517*# Agricultural Research Service, Weslaco, Tex.
SPECTRAL SURVEY OF IRRIGATED REGION CROPS AND SOILS Annual Report, 1 Oct. 1968–30 Sep. 1969
30 Sep. 1969 450 p refs
(NASA Order R-09-038-002)
(NASA-CR-107881) Avail: CFSTI CSCL 08G

Research reports on remote sensing investigations are presented. Applications include color recombinations imagery for soils and plants; reflectance of single leaves and plots of cotton, and detection of cellular discoloration in cotton; and the detection of insect damage and foot rot disease of citrus trees with infrared film. Reflectance produced by vegetation on a soil background was studied by isotropic light interacting with a compact plant leaf, plant irradiance specified by Duntley equations, and incident and reflected short wavelength radiation. The relationship between near infrared reflectance and cotton maturity is described. Aerial film types, photointerpretation, and mapper imagery are also discussed. Details are given on the discrimination of vegetation by multispectral reflectance, the discrimination on infrared film of crop species and soil conditions, and 9-channel scanner data. The procurement of a field spectrometer and random errors associated with a spectrophotometer are mentioned. Trips to Brazil and Mexico by the agriculture representative to NASA's International Participation Program are also reported. N.E.N.

N70-17897# New South Wales Univ., Kensington (Australia). School of Mining Engineering.
APPLICATION OF AERIAL GAMMA RADIATION SPECTROMETRY IN AUSTRALIAN MINERAL EXPLORATION
M. J. Lawrence 19 Mar. 1969 33 p refs Presented at the Australian Inst. of Mining and Metallurgy, Sydney, 1969 *Its* Geol. Paper No. 3
(CONF-690815-1) Avail: CFSTI

The practice and experience of Geophysical Resources Development Co. with the technique of airborne gamma spectrometry are outlined and its particular application to uranium search is discussed. The basic theoretical principles of natural radioactivity are reviewed. A brief history of radiation detection instrumentation is presented, together with the theory underlying its design and operation. The primary consideration in the selection of survey system parameters is the variation of gamma flux with height. Other factors are terrain clearance, aircraft speed, instrument time constant, and line spacing. Survey aircraft requirements are exceptional performance and dependability, high maneuverability, low stall and high cruise speeds, sufficient power for instrument supply, room for electronic installation, low initial and operating costs, and adaptability. NSA

N70-17884*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPLOITATION OF DIGITIZED GEOMAGNETIC DATA
Masahisa Sagiura Dec. 1969 19 p refs Presented at the Gen. Sci. Assembly of the Intern. Assoc. of Geomagnetism and Aeronomy, Madrid, 1–12 Sep. 1969
(NASA-TM-X-63803; X-612-69-553) Avail: CFSTI CSCL 08N

An international computerized center for the processing of geomagnetic data is proposed. Automatic digitized geomagnetic records processing methods are compared with conventional processes in terms of costs, timeliness, and dependability. D.L.G.

N70-17890# National Center for Atmospheric Research, Boulder, Colo.
INTERNAL GRAVITY AND ACOUSTIC WAVES: A COLLOQUIUM
Sep. 1969 393 p refs Held at Boulder, Colo., 17 Jun.–26 Jul. 1968 Prepared in cooperation with Colorado Univ.
(NCAR-TN-43) Avail: CFSTI

A colloquium was conducted on theory and specific problems of ionospheric disturbances manifested by gravity waves, the propagation of tropospheric disturbances upward into the high atmosphere, gravitational and thermal tidal motions, internal gravity waves and turbulence, and mountain waves. For individual titles, see N70-17690 through N70-17712.

N70-17891# Imperial Coll. of Science and Technology, London (England).
MOUNTAIN WAVES IN THE STRATOSPHERE
Francis H. Berkshire *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 1–21 refs (See N70-17690 06-13)
Avail: CFSTI

Significant radiation into the stratosphere can occur even when there is a deep intermediate layer of negligible stability, provided the lower layer is sufficiently stable. If this does occur, the radiation can be even more pronounced than in the corresponding case of uniform stratification. By using the methods outlined, the dependence of the amplitudes and critical wave numbers on the stability parameters and layer thicknesses can be determined. Author

N70-17892# Colorado Univ., Boulder.
AURORAL HEATING AND INTERNAL GRAVITY WAVES
W. Blumen *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 23–28 refs (See N70-17690 06-13) Avail: CFSTI

An estimate is made of the gravity-wave energy flux from the region of joule heating in the auroral zone. The important parameters associated with the auroral electrojet were surveyed. Most of the information concerning the spatial and temporal distribution

of the electrojet is inferred from various types of measurements made during geomagnetic activity. It is not known whether the most intense currents were flowing during the periods when these measurements were made, and it is assumed that the current distribution could be variable in space and time. In computing the energy flux, viscosity heat conduction and the earth's rotation were not considered, and the perturbation motion was superposed on a resting hydrostatic and isothermal atmosphere. Internal acoustic waves were eliminated from the model so that all available heat energy is entirely coupled into gravity wave energy. R.B.

N70-17693# Cambridge Univ. (England).
MOMENTUM TRANSPORT BY INTERNAL GRAVITY WAVES
F. P. Bretherton *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 29–45 refs (See N70-17690 06-13)
Avail: CFSTI

The momentum transferred by gravity waves in an atmosphere with a mean wind is investigated. Specific consideration is given to a steadily flowing, nonrotating, inviscid atmosphere with a typical wind profile U(z) in the x direction, and possibly a component V(z) in the y direction where z is the height above sea level. Thin layers of clear air turbulence are possible at certain fairly well defined layers in the atmosphere. A flow over a rough, hilly terrain with anisotropic topography is assumed. This assumption ensures that the gravity waves generated by the terrain have amplitudes small enough to justify linearization of the basic equations. Conditions are assumed such that they justify a Boussinesq approximation. R.B.

N70-17700# National Center for Atmospheric Research, Boulder, Colo.
FRONT RANGE MOUNTAIN WAVES, PART 1
D. K. Lilly *In its* Internal Gravity and Acoustic Waves Sep. 1969 p 131–132 (See N70-17690 06-13)
Avail: CFSTI

The lee wave observational program in the Boulder, Colorado area is considered. Simultaneous instrumented airplane flights east and west of the Boulder area are outlined for days when considerable lee wave activity was believed to be present. The reduction of data and accuracy of measurements is discussed. R.B.

N70-17701# Chicago Univ., Ill.
ATMOSPHERIC TIDES, PART 1
R. S. Lindzen *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 133–153 refs (See N70-17690 06-13)
Avail: CFSTI

Atmospheric tides are regarded as internal gravity waves where the excitation is relatively well known, as opposed to many other examples of atmospheric gravity wave propagation, in which the excitation is poorly known, if at all. Gravitational tides, which are affected by the motion of the sun and moon, and the thermally driven tide are considered. The dominant components of the solar and lunar semidiurnal tides are contrasted. The difference in amplitude of the two components is explained by suppression of the diurnal oscillation, brought about by the fact that most of the diurnal excitation goes into modes which cannot propagate vertically due to the earth's rotation. The various approaches to tidal theory are outlined, and the theory is applied to account for worldwide pressure measurements at the earth's surface. R.B.

N70-17702# Imperial Coll. of Science and Technology, London (England).
WAVE PROPAGATION IN A STRATIFIED ATMOSPHERE
Robert Mac Kinnon *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 155–177 refs (See N70-17690 06-13)
Avail: CFSTI

The effects of nuclear explosions on wave propagation in a stratified atmosphere are considered. Since wind affects speeds of propagation, wind profiles were put into the model atmosphere. A temperature profile is assumed which is piecewise linear with two sound channels, and superimposed on this profile are some piecewise linear wind profiles. The continuum equations of motion are applied to the physical situation, and an inviscid perfect gas and a flat earth are assumed. Microbarograms taken at two distant points east and west of the explosions show that winds do affect the propagation of the pressure waves, although the speed of propagation is not uniform because of energy trapping for waves of a certain period and for a certain wind profile. The problem of determining the net mean vertical energy flux variations with altitude is also discussed. R.B.

N70-17703# National Center for Atmospheric Research, Boulder, Colo. Desert Research Inst.
ACOUSTIC MAGNETO-GRAVITY WAVES
Alden Mc Lellan, IV *In its* Internal Gravity and Acoustic Waves Sep. 1969 p 179–199 (See N70-17690 06-13)
Avail: CFSTI

Small amplitude low frequency waves are treated for conditions corresponding to the solar corona of the upper ionosphere, i.e. for a plasma of infinite conductivity. A local dispersion relation is derived and four limiting cases are examined. These cases correspond to sound waves, acoustic gravity waves, pure gravity waves, and magneto-sonic waves. The local dispersion relation is also expressed in a non-dimensional form independent of the constants describing a particular atmosphere, and two special cases are examined. The mathematical model consists of a constant external magnetic field, constant gravitational field, and wave number vector, and requires a three-dimensional formulation. The atmosphere is considered isothermal and of infinite conductivity. Dissipative effects due to viscosity, electrical resistivity, and heat conductivity are ignored. Author

N70-17705# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.
DUCTING OF INTERNAL GRAVITY WAVES IN A TEMPERATURE- AND WIND-STRATIFIED ATMOSPHERE
C. A. Reddy *In its* Internal Gravity and Acoustic Waves Sep. 1969 p 229–257 refs (See N70-17690 06-13)
Avail: CFSTI

Using the multilayer approximation for a realistic atmosphere with height variations of temperature and background winds, the imperfectly ducted modes of internal gravity waves are identified. The analysis brings out clearly the importance of wind-induced reflections in determining the characteristics of partially ducted internal gravity waves. Negligence of the wind-induced reflections can lead to substantial errors in any quantitative comparison of theoretically predicted and observed gravity wave modes. Further, it is found that even in the presence of wind effects, the horizontal group velocity cannot exceed the horizontal phase velocity for these partially ducted modes. A few modes exist with a horizontal phase speed exceeding the 312 m/sec value found for the non-dispersive mode, if the temperature structure above 250 km is taken into account. All these high velocity modes are independent of the presence of a reflecting ground at the lower boundary, because these modes are ducted primarily in the thermosphere. Author

N70-17711# Alaska Univ., College. Geophysical Inst.
AURORAL INFRASONIC WAVES
Charles R. Wilson *In* Natl. Center for Atmospheric Res. Internal Gravity and Acoustic Waves Sep. 1969 p 329–389 refs (See N70-17690 06-13)
Avail: CFSTI

The morphology of auroral infrasonic waves at College, Alaska is related to the temporal and spatial distributions of supersonic auroral motions that develop within the auroral oval

during polar magnetic substorms. The break-up phase of the auroral substorm results in the rapid auroral motions that generate the observed infrasonic waves. Direct observations of infrasonic wave packets from over-head supersonic auroral forms, as well as the comparison of the morphologies of infrasonic waves and auroral motions are used to verify a shock wave model for the generation of auroral infrasonic waves. Electrodynamic drift and joule heating associated with the auroral electrojets in auroras which produce infrasonic shock waves are accepted as the basic processes which generate the initial acoustic pulse within a moving auroral form. Author

N70-17721*# Fairchild Camera and Instrument Corp., Syosset, N.Y. Space and Defense Systems Div.

EARTH RESOURCES DATA PROCESSING CENTER STUDY. VOLUME 1: PROGRAM SUMMARY Final Report

15 Sep. 1969 47 p

(Contract NASW-1811)

(NASA-CR-107884; ED-AA-113) Avail: CFSTI CSCL 08G

The results of a comprehensive study aimed at assisting NASA Headquarters in its task of planning R&D programs and developing an operational capability to acquire, process and disseminate remotely-sensed earth resources data to appropriate experimenters and users are described. A review is presented of the basic objectives and requirements of the major government support agencies and experimenter groups associated with the Earth Resources Program. Future trends in the Earth Resources Program are delineated, with emphasis on the Houston aircraft program, its eventual coordination with spacecraft collection activities, and its attendant ground data processing requirements. Recommendations and conclusions concerning future effort aimed at furthering the growth of the earth resources data processing facilities at the Manned Spacecraft Center are developed. Author

N70-17900# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.

BIBLIOGRAPHY OF PUBLICATIONS AND PATENTS VOLUME 3 Final Summary Report, 1951 - 1969

K. T. Morse, ed. Jun. 1969 87 p refs

(Contracts Nonr-266(84); Nonr-266(66))

(AD-696695; CU-214-69-ONR-266-Phys-Vol-3) Avail: CFSTI CSCL 8/10

The contributions to scientific journals, technical reports, status reports, and patents originating at the Hudson Laboratories between 1951 and 1969 are listed in their numbered series. Author (TAB)

N70-17974# Stanford Research Inst., Menlo Park, Calif.

SEISMIC AND METEOROLOGICAL RESEARCH PROGRAM. VOLUME 2 Final Report

C. G. Bufe, J. D. Eisler, D. R. Grine, J. F. Herndal, and W. B. Johnson, Jr. et al Oct. 1968 387 p refs Prepared in cooperation with Michigan Univ.

(Contract DCA100-68-C-0003)

(AD-694101; Rept-1111-11-F(2)-Vol-2) Avail: CFSTI CSCL 08/11

Seismic recordings and meteorological correlations obtained from four test sites in Thailand are reported. Illustrations and diagrams of the instrumentation used are included. Photographs of foliage surrounding the sites are also presented. D.L.G.

N70-18005 Oregon Univ., Portland.

ARCHEOLOGICAL DATING BY MEANS OF VOLCANIC ASH STRATA

Michael Nowak (Ph.D. Thesis) 1968 220 p refs

Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-8654

Four ash horizons provide age estimates for occupational material in sites which were surveyed or tested, but from which no radiocarbon samples were obtained. While index of refraction serves as one of the principal guides in the petrographic identification of ash strata, it is always supported by relative stratigraphic position, and often by the color of a deposit. Heavy mineral frequency distribution counts were made on 71 out of 250 samples of volcanic ash. The final test to which the volcanic ash horizons were subjected was one of agreement in C-14 age. The ability to chronologically assess occupational remains at sites only briefly tested, by means of volcanic ash horizons is demonstrated in the archeological work undertaken in Katmai National Monument and vicinity. Dissert. Abstr.

N70-18015 India. Meteorological Dept., New Delhi.

MAGNETIC, METEOROLOGICAL AND ATMOSPHERIC ELECTRIC OBSERVATIONS MADE AT THE GOVERNMENT OBSERVATORIES, BOMBAY AND ALIBAG, IN THE YEAR 1966. PART 2: METEOROLOGICAL AND ATMOSPHERIC ELECTRIC OBSERVATIONS MADE AT COLABA, BOMBAY

K. N. Rao and B. N. Bhargava 1969 88 p

(DGO-77.66-Pt-2) Copyright. Avail: Issuing Activity

Meteorological and atmospheric electric observations reported cover the salient weather features of Bombay as well as meteorological and seismic recordings at Colaba during 1966. During this year, 375 seismic disturbances were recorded of which 8 were classified as severe earth quake shocks of great intensity. G.G.

N70-18017*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INFERENCE OF TEMPERATURE AND WATER-VAPOR STRUCTURE IN THE STRATOSPHERE FROM LIMB RADIANCE PROFILES

Thomas B. Mc Kee Washington Feb. 1970 25 p refs

(NASA-TM-X-1943; L-7050) Avail: CFSTI CSCL 04A

Techniques to infer stratospheric temperature and water-vapor mixing ratio as a function of pressure from limb radiance profiles are presented. Requirements for accurate pointing information were eliminated, and only the easily obtained vertical scan rate is needed. Example calculations of inferred temperatures and water-vapor mixing ratios from unperturbed and perturbed radiance profiles are given. Radiance profiles due to thermal emission of carbon dioxide were used for temperature inference, and radiance profiles due to thermal emission of water vapor were used for mixing-ratio inference. Pressure ranges of the inferred values are 0.3 to 100 millibars for temperature and 3 to 200 millibars for water-vapor mixing ratio. Author

N70-18050# Minnesota Univ., Minneapolis. School of Physics and Astronomy.

POSSIBLE IDENTIFICATION OF VOLCANIC DUST IN THE STRATOSPHERE

James M. Rosen Oct 1969 17 p refs

(Contract N00014-67-A-0113)

(AD-696526; AP-28) Avail: CFSTI CSCL 4/1

Balloon soundings of the atmospheric aerosol made at three different latitudes confirm the existence of a widespread dust layer over the Northern Hemisphere. Soundings made at Minneapolis over a period of five years show seasonal fluctuations in the total stratospheric dust by as much as a factor of four with a suggestion of a secular decrease from 1963 to 1968. Soundings made at Panama show a decrease of the dust by a factor of ten from 1966 to 1968. This rapid decrease in the amount of the equatorial dust is not inconsistent with the estimated rates of dilution and dispersion of radioactive bomb debris by horizontal and vertical eddy motion. The spectrum of particle size of the Panama aerosol is considerably flatter than that of the mid-latitude aerosol, indicating they may be of different origin. It is suggested that these additional equatorial particles are the residue of volcanic material injected into the stratosphere in the Bali explosion of 1963. A more definitive measurement of the aerosol spectrum at mid-latitude shows a slope only slightly flatter than that reported by Junge in 1961 but with considerably greater concentration of particles larger than 1 micron. This could be caused by an increase in the number of large particles after the Bali event or a loss of large volatile particles counted by filter methods. Author (TAB)

N70-18052# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

BIBLIOGRAPHY ON COLD REGIONS SCIENCE AND TECHNOLOGY. VOLUME 23

Jul. 1969 325 p refs

(AD-696404; CRREL-12-Vol-23) Avail: CFSTI CSCL 14/2

The Bibliography on Cold Regions Science and Technology, CRREL Report 12, was first published in 1951 and is a continuing publication of the Cold Regions Bibliography Section in the Science and Technology Division of the Library of Congress. It is sponsored by and prepared for the Cold Regions Research and Engineering Laboratory (formerly Snow, Ice and Permafrost Research Establishment) of the U.S. Army Corps of Engineers. Beginning with volume 20 the title was changed to Bibliography on Snow, Ice and Frozen Ground. The present volume features another change in title, reflecting the somewhat expanded subject coverage, and especially the added emphasis on engineering. Author (TAB)

N70-18068# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

PREDICTED DEPTH OF FREEZE OR THAW IN SOILS BY CLIMATOLOGICAL ANALYSIS OF CUMULATIVE HEAT FLOW

Ronald F. Scott Sep. 1969 54 p

(AD-696414; CRREL-TR-195) Avail: CFSTI CSCL 8/12

A procedure is described for applying the cumulative heat flow concept previously developed by the author to the prediction of the depth of freeze and thaw in soils. Step-by-step instructions for performing the calculations are given. The procedure is illustrated by detailed application to selected turfed and paved areas for specific periods at four specific sites: Fairbanks and Kotzebue, Alaska; Thule AB, Greenland; and Dow AFB, Bangor, Maine. Results of the study indicated negligible variation from measured values. Mathematical derivations are presented in Appendix A, and the development of the relationship between cumulative heat flow through the ground surface and thaw (frost) penetration is given in Appendix B. Author (TAB)

N70-18068# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

BIBLIOGRAPHY ON COLD REGIONS SCIENCE AND TECHNOLOGY. VOLUME 23, INDEX

Jul. 1969 236 p refs

(AD-696403; CRREL-12-VOL-23-INDEX) Avail: CFSTI CSCL 14/2

The Bibliography on Cold Regions Science and Technology, CRREL Report 12, was first published in 1951 and is a continuing publication of the Cold Regions Bibliography Section in the Science and Technology Division of the Library of Congress. Bibliography on Snow, Ice and Frozen Ground features another change in title, reflecting the somewhat expanded subject coverage, and especially the added emphasis on engineering. Author (TAB)

N70-18108*# Texas A&M Univ., College Station. Dept. of Oceanography.

OCEANOGRAPHY USING REMOTE SENSORS Final Report, Jun. 1966 - 15 Dec. 1968

Luis R. A. Capurro 15 Jan. 1969 109 p refs Sponsored by NASA

(Contract Nonr-2119(04))

(NASA-CR-107898; AD-682939; REF-69-2F) Avail: CFSTI CSCL 08J

Airborne tests of multispectral remote sensors were conducted on eight occasions during July 1966 to September 1968 over the Mississippi Delta area and Eastern Gulf of Mexico to determine their usefulness in surveying river, coastal and deep-sea phenomena. Four of these tests were supported concurrently by oceanographic research vessels, passive remote sensors, including metric cameras, infrared imagers and microwave radiometers, were flown at 1,500, 5,000, 10,000 and 50,000 feet above sea level. Studies into the relationship between low cloud development and horizontal anomalies in the sea surface temperature field and studies into basic microwave research have been conducted. The following features of the Mississippi River were surveyed by remote sensors: (1) location of surface frontal zones of convergence, (2) determination of surface water mass type, (3) small scale pattern of mixing, (4) location of internal waves and (5) general outflow pattern shape and extent. Author (TAB)

N70-18162# Bureau of Mines, Bartlesville, Okla.

GEOCHEMISTRY OF SOME PETROLEUM-ASSOCIATED WATERS FROM LOUISIANA

A. Gene Collins Jan. 1970 36 p refs

(BM-RI-7326) Avail: CFSTI

Some of the geochemical relationships that exist between subsurface fluids and the associated geologic strata in petroleum producing areas of Louisiana have been determined. Samples of petroleum-associated water were obtained from 126 wells in Louisiana that produced from sediments of three geologic ages: tertiary, cretaceous, and jurassic. The samples were transported to a central laboratory for analysis of chemical composition, using standard methods, to determine if the compositions varied with the geologic strata of their source and, if so, why. The dissolved constituents were compared with those of a brine that was concentrated by evaporation. The concentrations of bromide, calcium, and strontium were useful in distinguishing the brines produced from sediments of a late age from those of an earlier age. The concentration ratios of Mg (total equivalent magnesium) and bromide indicated that dolomitization probably had occurred and altered the composition of the brines. A principal-components analysis of the data indicated an inverse relationship between depth and concentrations of bromide, strontium, calcium, and lithium. 000

N70-18209# Finnish Meteorological Office, Helsinki.

SOIL TEMPERATURE MEASUREMENTS: RESULTS OF SOIL TEMPERATURE MEASUREMENTS AT SODANKYLA OBSERVATORY, 1957 - 1960

Pentti Rapeli Mar. 1969 19 p *Its* Soil Temp. Meas. no. 2

Avail: CFSTI

Results of soil temperature measurements made at the Sodankyla Meteorological Observatory, Finland over the period 1957 - 1960 are tabulated and the measurement method described. The temperature at 100 cm, as measured by the thermistor, was taken as the basic value for the recordings. During winter, when these instruments were not always read on a daily basis, the values for intermediate days were obtained by interpolation. A.C.R.

N70-18210# McDonnell-Douglas Co., Huntington Beach, Calif. Western Div.

COORDINATE TRANSFORMATIONS USED IN MAGNETOSPHERIC PHYSICS

W. P. Olson Jan. 1970 16 p

(MDAC-Paper-WD-1145) Avail: CFSTI

Three systems are frequently used in addition to the common geographic and geomagnetic coordinates; these are: ecliptic solar magnetospheric, and solar magnetic coordinates. All three have their origin at the center of the earth, and each is defined by three mutually-orthogonal axes. Because the solar wind is not generally incident upon the magnetosphere from the direction of the optical sun, it is desirable to define a fourth coordinate system. It is similar to the solar-magnetospheric coordinate and is defined as the wind-magnetospheric system. Expressions are derived by which these coordinates can be determined and transformed from one system to the other. Author

N70-18213# Swedish Board of Shipping and Navigation, Stockholm.

THE AEROMAGNETIC SURVEY OF DENMARK, FINLAND, NORWAY, SWEDEN 1965

1969 60 p refs

Avail: CFSTI

Results of a geomagnetic survey of Denmark, Finland, Norway, Sweden and their adjacent waters in autumn 1965 are charted and

tabulated as a contribution to the World Magnetic Survey by the four countries in cooperation with Canada. The measurements were conducted in Canada at the Dominion Observatory as part of a larger survey which extended from the west coast of Greenland to the eastern boundary of Finland. A three-component airborne magnetometer was flown in a chartered DC-6 aircraft. Geomagnetic elements measured included D, H, Z, and F. The average spacing of the flight lines was 35 km, with an average flight altitude of 3 km above sea level. Results were conveyed to the 13th General Assembly of the International Union of Geodesy and Geophysics. A.C.R.

N70-18291 National Lending Library for Science and Technology, Boston Spa (England).
THE AGROMETEOROLOGICAL EFFECTIVENESS OF THE COMBINED USE OF SHELTER-BELTS AND FARMING METHODS AGAINST WIND EROSION OF THE SOIL
S. N. Adrianov 28 Jul. 1969 12 p Transl. into ENGLISH from Glav. Aprav. Gidromet. Sluz., Met. Gidr. (Russia), no. 7, 1967 p 82–87
(NLL-M-7763-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Methods used in Kazahstan and Western Siberia to reduce wind damage are described. Strips of stubble or grass, alternate strips of crops, and terracing were tried, but were found not to provide complete protection. Shelter belts consisting of rows of trees retained snow two to six times as much as shelterless areas and greatly reduced soil depletion. A well defined zone where no soil is blown away was noted on both sides of a tree belt for a distance of 20 to 40 times its height, depending on the soil type. It is recommended that rows of birch or puplar be set 300 to 350 m apart on brown soils, 400 to 450 m apart on southern chernozem, and 200 to 250 m apart on sandy soils. Wheat production on sheltered areas showed an increase of about 3700 kg/hectar on brown soils to 10,500 kg/hectar on chernozem. N.E.N.

N70-18303# Joint Publications Research Service, Washington, D.C.
DETERMINING GEOPHYSICAL PARAMETERS FROM THERMAL RADIO EMISSIONS OBTAINED BY THE "KOSMOS-243" ARTIFICIAL EARTH SATELLITE
A. Ye. Basharinov et al 18 Dec. 1969 9 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 188, no. 6, 1969 p 1273–1276
(JPRS-49474) Avail: CFSTI

The artificial earth satellite Cosmos-243 measured terrestrial radiothermal and corresponding emission of the atmosphere at wavelengths of 8.5, 3.4, 1.35, and 0.8 cm. The measurements were made to develop methods for geophysical investigations of the atmosphere and the underlying surface on the basis of emitted radiation in the radio range. R.B.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-16908 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIMENTAL DATA ON THE INFLUENCE OF THE PARAMETERS OF THE THERMAL ASSEMBLY ON THE READINGS OF THERMISTOR MMT-1 IN THE FREE ATMOSPHERE
V. N. Arbuzova et al 23 Sep. 1969 15 p refs Transl. into ENGLISH from Cent. Aerol. Obs., T. Vyp. (Moscow), no. 74, 1966 p 53–60
(NLL-M-7779-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

Air temperatures are measured by MMT-1 thermistors in the standard thermal unit of an RKZ-1 radiosonde and in experimental thermal units differing in some respects (length, support, etc.) from the standard ones. Author

N70-16911# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
LIQUID HELIUM TEMPERATURE cw NMR S/N IMPROVEMENT USING A MOSFET rf AMPLIFIER
D. W. Alderman Jun. 1969 29 p refs
(Rept-1176) Avail: CFSTI

Improvement of signal to noise ratio of cw NMR spectrometers by cooling circuit components to liquid helium temperature is discussed. Criteria for design of a low temperature circuit using a twin T bridge and MOSFET amplifier are presented. A liquid helium temperature spectrometer for operation at 16 MHz which improves signal to noise ratio by a factor of five over conventional techniques is described. Author

N70-17051# Pennsylvania State Univ., University Park. Field Emission Lab.
FIELD ION MICROSCOPY Final Report, Jun. 1959 May 1969
Erwin W. Mueller 30 Sep. 1969 15 p refs
(Contract Nonr-659(23))
(AD-696987) Avail: CFSTI CSCL 14/2

The objectives of this project include the development of improved field-ion microscopes, several means of image intensification, and experiments to clarify the physical processes of ion image formation. Applications of field ion microscopy to the study of lattice imperfections and to order-disorder structures of Pt-Co alloys are described. A bibliography containing twenty-five publications and twenty presentations at the annual Field Emission Symposia is given. Author (TAB)

N70-17100# ARO, Inc., Arnold Air Force Station, Tenn.
A METHOD FOR CALIBRATING A CONE-PROBE FLOW FIELD MEASURING INSTRUMENT Final Report, Jul. 1968–Jul. 1969
R. C. Bauer AEDC Nov. 1969 30 p refs
(Contract F40600-69-C-0001)
(AD-697023; AEDC-TR-69-201) Avail: CFSTI CSCL 14/2

A simple method is presented for calibrating a cone-probe type of flow field measuring instrument. The calibration procedure requires data from only four orientations of the cone-probe in a quantitatively unknown flow field. Only changes in orientation must be known. It is then possible to use these data to determine the Mach number, total pressure, and flow angle of the unknown flow field; the constants in calibration equations for pitch and yaw flow angles; and the average static pressure. The method is verified by comparing with calibration results obtained in a conventional manner. Author (TAB)

N70-17163# New York Univ., N.Y. Lab. for Electroscience Research.
COMPUTER ANIMATION: A LITERATURE SURVEY
J. Meltzer Oct. 1969 27 p refs Sponsored in part by Bell Telephone Labs.
(Contract N00014-67-A-0467)
(AD-696989; TR-403-8) Avail: CFSTI CSCL 14/5

The report is a literature survey of works dealing expressly with computer animation of motion picture films. The papers are divided into the areas of general discussions, animation languages, and specific applications. Author (TAB)

N70-17161# Army Foreign Science and Technology Center, Washington, D.C.

DEVELOPMENT OF METEOROLOGICAL INSTRUMENTS

M. S. Stemzat 22 Oct. 1969 24 p refs Transl. into ENGLISH from Glavnaya Geofizicheskaya Observ. (USSR), no. 2, 1967 p 153 166

(AD-697073; FSTC-HT-23-630-69) Avail: CFSTI CSCL 4/2

Advances in meteorology during 50 years of Soviet rule are reviewed. Instruments developed for aerological studies, for measurement of the surface layer of the atmosphere, and special meteorological instruments developed for scientific research and for the national economy are discussed. Contributions of prominent Soviet scientists are outlined. Author (TAB)

N70-17217# Institut Royal Meteorologique de Belgique, Brussels.

RESULTS OF THE INTERNATIONAL COMPARISON OF THE INSTRUMENTS MEASURING THE ARTIFICIAL BETA RADIOACTIVITY OF DUSTS IN AIR (FIXED FILTER DEVICES) ORGANIZED BY THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM [RESULTATS DE LA COMPARAISON INTERNATIONALE DES INSTRUMENTS DE MESURE DE LA RADIOACTIVITE ARTIFICIELLE BETA DES POUSSIERES DE L'AIR (APPAREILS A FILTRES FIXES) ORGANISEE PAR L'INSTITUT ROYAL METEOROLOGIQUE DE BELGIQUE]

J. Grandjean, R. Sneyers, and C. Levert 1969 27 p refs In FRENCH *Its* Publ., Ser. A, No. 67

Avail: CFSTI

Several instruments in use at European air pollution survey stations were brought together and used to measure artificial beta radioactivity. Their filters were than analyzed in the usual way at the home station and the final results are compared and discussed. ESRO

N70-17257# Utah State Univ., Logan. Upper Air Research Labs.

ROCKET INSTRUMENTATION FOR PCA MEASUREMENTS BLACK BRANT 17.750 AND 17.751

David A. Burt Jun. 1969 85 p refs

(Contract F19628-67-C-0275)

(AD-696100; AFCRL-69-0282; UU-69-2; SR-3) Avail: CFSTI CSCL 19/7

This report discusses instruments contained in the payloads of Black Brants 17.750 and 17.751. These instruments were designed to measure characteristics of the D-region associated with polar cap absorption (PCA) events. The measurements included proton fluxes, x-ray emissions, total particle energy deposition, Lyman-alpha radiation, electron and ion densities and temperatures, and photometric emissions in the ionosphere. Author (TAB)

N70-17276# Panametrics, Inc., Waltham, Mass.

DESIGN AND DEVELOPMENT OF AN ISOTOPIC ALTIMETER SETTING INDICATOR, VOLUME 1 Final Report

B. Sellers and P. Morel Jun. 1969 91 p refs

(Contract FA-67-WA-1659)

(AD-696961; FAA-RD-69-38-1) Avail: CFSTI CSCL 18/4

A need exists for an altimeter setting indicator system capable of operating 5 inches of mercury. This report presents the results of a design and development program having the objective of determining the feasibility of using a radioisotopic source as the basic sensing element in such a system. The isotopic source selected for use in this system is the 5.5 Me V alpha emitter, Americium-241, whose half life is 458 years. The basic parameter measured by this, and other isotopic emitters, is density. Thus, in order to make a measurement of pressure by direct sensing with such a source, it is necessary either to place the sensor in a controlled temperature enclosure which is connected to the point at which pressure is to be measured, or to monitor the temperature in the enclosure and utilize that information along with the density to calculate the pressure. The temperature must either be controlled or measured to an accuracy of about plus or minus .02 C to meet the design objective on pressure. The approach utilized in the present system was that of a controlled enclosure. Author (TAB)

N70-17311*# Tetra Tech, Inc., Pasadena, Calif.

DECLINATION RATE AND RELATED INTERFEROMETRIC SCHEMES FOR PRECISE SATELLITE TRACKING Final Report

W. Wells, M. Milder, and H. Hodara Nov. 1969 160 p refs

(Contract NASw-1872)

(NASA-CR-107862; TC-161) Avail: CFSTI CSCL 14B

A study of optical and microwave interferometers and related systems for precision satellite tracking was motivated by the high angular resolutions reported with interferometric systems. Five novel tracking schemes are analyzed and compared. Systems 3, a 10-micron dec-rate system, and 4, differential very-long-baseline interferometer system, are strictly interferometric; Systems 2, a differential lidar system, and 5, a differential range rate, resemble interferometers, measuring angles relative to a baseline joining two stations, and System 1, a star occultation system, is included for comparison. In conclusion, the 10-micron dec-rate system is recommended for the ATS-F mission to evaluate optical interferometry followed, if successful, by steps toward the differential lidar system. Author

N70-17316*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

TECHNICAL DOCUMENTATION FOR THE MARK 1 MODEL OF THE LASER ABSOLUTE GRAVIMETER Technical Memorandum

Paul Craven and O. K. Hudson 7 May 1969 67 p refs

(NASA-TM-X-53832) Avail: CFSTI CSCL 14B

A machine to measure the absolute acceleration due to gravity is investigated. The gravity meter (gravimeter) is of the falling mass type. The falling mass is the moving mirror of a Michelson interferometer. The interferometer, with a highly stable He – Ne laser as the light source, is used to measure length. Time is measured using a 1 MHz oscillator as a time base for two time-interval counters. Errors in the value of the acceleration measurement result mainly from the following: the high seismic noise level in the room where the gravimeter was housed, the beam splitter and stationary mirror not being in vacuum, the motion due to the air cushion, the vibration introduced into the gravimeter system by the release system, and, possibly misalignment of the beam to the bird. Author

N70-17334# Commissariat a l'Energie Atomique, Cadarache. Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE DEVELOPMENT OF A GAMMA RADIATION CAMERA FOR USE IN SCINTIGRAPHY [CONTRIBUTION A L'ETUDE ET A LA REALISATION D'UNE CAMERA A RAYONNEMENT GAMMA EN VUE D'UNE APPLICATION A LA SCINTIGRAPHIE]

Jacques Felix (Ph.D. Thesis—Aix-Marseille Univ.) Oct. 1969 64 p refs In FRENCH; ENGLISH summary

(CEA-R-3649) Avail: CFSTI

The properties of the detection head of a multichannel collimating grid camera were investigated. The object has been to show the disadvantages of present equipment, and to propose possible solutions for overcoming them; firstly, by improving the methods used for collecting data and the performaces of the relevant equipment, and secondly, by devising methods for processing the data to reduce image distortion, primarily the astigmatism due to the collimator. The formation of the image by means of the collimating grid is discussed, and systems which could be used for acquiring data are examined. The experiments carried out are summarized and an experimental program for the development of a prototype is proposed. Author (ESRO)

N70-17335# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
PROCEEDINGS OF THE ITC POST-CONGRESS SEMINAR
J. Kure, ed. and D. A. Tait, ed. Jul. 1969 201 p Held at Delft, 29 Jul. - 2 Aug. 1968 *Its* Ser. A No. 47
Avail: CFSTI

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11. CADASTRAL AND URBAN MAPPING J. Visser p 166 - 177 (See N70-17346 06-13)
12. AUTOMATIC DRAWING TABLES D. Eckhart p 178 - 186 (See N70-17347 06-14)
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N70-17337# International Institute Aerial Survey and Earth Sciences, Delft (Netherlands).
ACQUISITION OF PHOTOGRAPHY
F. L. Corten *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 20 - 37 (See N70-17335 06-14)
Avail: CFSTI

The flight and navigational aspects of obtaining terrain data through aerial photography are discussed. The choice of aircraft is governed by suitability rather than by cost: twin engine propeller-driven aircraft are standard equipment, and single-engine aircraft and helicopters are also being used. The economy and investment cost of different navigation instrument systems are given and it is stated that reasonable results can be achieved with standard survey navigation instruments provided experienced and trained personnel use them. In-flight acquisition of camera station elements is discussed with respect to planimetric positioning, altitude, and verticality. Different methods and instruments are described, and their accuracies and disadvantages are indicated. N.E.N.

N70-17338# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
CAMERAS, MATERIALS AND PROCESSING
F. L. Corten *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 38 - 47 (See N70-17335 06-14)
Avail: CFSTI

The determination of geometrical accuracy in aerial survey photogrammetry is discussed. It is suggested that an analysis be made of sources of error to aid the photogrammetrist in eliminating them or compensating for them. Forms of calibration for checking results are identified as analytical, partial, and integral calibration. It is pointed out that specifications must be established with respect to the ultimate object and the ultimate accuracies. Some areas of unknown factors or possible methods include the use of reseau, temperature gradients in cameras and through the camera window, atmospheric effects, standard automatic processing methods, and humidity control. A list of new cameras is given. N.E.N.

N70-17339# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
DATA ACQUISITION IN AERIAL TRIANGULATION
K. Kubik *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 48 - 62 (See N70-17335 06-14)
Avail: CFSTI

The available data and the new techniques and equipment for aerial triangulation are summarized. A method of triangulation using blocks with 60% side lap between neighboring strips is briefly described, and the possibilities of using auxiliary data and reseau photography are considered. The point transfer operation, methods of aerial triangulation, and the time requirements are mentioned. Characteristics of new point transfer devices and new monocomparators are tabulated. N.E.N.

N70-17341# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
ACCURACY OF AERIAL TRIANGULATION
H. G. Jerie *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 77 - 90 (See N70-17335 06-14)
Avail: CFSTI

The problem of accuracy is discussed briefly from the planning point of view. The factors influencing accuracy are listed, and possibilities of establishing the required models are identified. It is considered that the only feasible solution is achieved by a combination of empirical and theoretical studies; that is, results obtained from stochastic and mathematical models should be compared with those from selected practical tests. N.E.N.

N70-17342# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
PHOTOGRAMMETRIC RESTITUTION INSTRUMENTS
B. Makarovic *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 91 - 120 (See N70-17335 06-14)
Avail: CFSTI

The trends in equipment development are discussed, and the properties of the instruments are tabulated. The availability of superwide angle photography resulted in new instrument types facilitating the reconstruction of conformal bundles of rays. Digital techniques stimulated development of new comparator types, the adaptation of conventional plotters for triangulation, and the development of automatic coordinatographs. It is considered that automatic correlators are particularly convenient for this profiling mode and will increase production rates. The instruments are classified into universal systems, precision plotters, and topographic plotters, and the tabulated data include input, output, projection system, observation system, tracking and measuring units, plotting device, and coordinate recording and other devices. N.E.N.

N70-17343# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
ORTHOPHOTOGRAPHY, PRODUCTION AND APPLICATIONS
J. Visser *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 120 - 137 (See N70-17335 06-14)
Avail: CFSTI

Orthophoto instruments with manual and automatic traversing, and their operation are briefly described. Specific applications in several countries are indicated and the map scale, map type, and equipment are given. The advantages of orthophotomaps, such as production time and amount of information, are mentioned. N.E.N.

N70-17347# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
AUTOMATIC DRAWING TABLES
D. Eckhart *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 178 186 (See N70-17335 06-14)
Avail: CFSTI

The characteristics and structure of automatic drawing tables are briefly described for use with a processing computer in photogrammetry. Several tables are listed, and data are given on the quality, size, control, resolution, and price. It is pointed out that the precision equipment is expensive but is capable of high line production. N.E.N.

N70-17348# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
EVALUATION OF PRESENT SITUATION AND PREDICTION OF FUTURE DEVELOPMENTS IN PHOTOGRAMMETRY
W. Schermerhorn *In its* Proc. of the ITC Post-Congr. Seminar Jul. 1969 p 187 - 197 (See N70-17335 06-14)
Avail: CFSTI

The problems of photogrammetry are identified as knowing what type of information can be obtained from the instruments, minor control point determination by means of aerial triangulation, and map production. It is stated that orthophotographs are receiving attention because it is possible to automate their production and they are regarded as superior products. Of the possibilities for the future mention is made of new methods of representing the earth's surface. The educational problems in training engineers are also described. N.E.N.

N70-17359*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HOLOGRAPHIC OPTICAL DATA PROCESSING
Rodney W. Jenkins 21 Nov. 1969 36 p refs
(NASA-TM-X-53961) Avail: CFSTI CSCL 14E

To process optical data is to perform mathematical operations on optical inputs. This paper describes the holographic technique and its application to optical subtraction and pattern recognition (matched filtering). Also, experimental results that are presented verify the theory and the appendixes show the Fourier transformation operator property of a lens and input translation invariance of the matched filtered output. Author

N70-17373# Royal Aircraft Establishment, Farnborough (England).
DESIGN CRITERIA AND EVALUATION TECHNIQUES FOR CYLINDRICAL LANGMUIR PROBES
J. Knight Jul. 1969 34 p refs
(RAE-TR-69143) Copyright. Avail: CFSTI

Factors restricting the choice of dimensions for single Langmuir probes are derived generally, and evaluated for the particular case of a thermally ionized potassium plasma. For low-temperature, high-density plasmas of this type the range of probe size is shown to be severely limited unless only a small part of the electron population is sampled. Techniques for the evaluation of the Langmuir probe characteristics are described which are particularly useful when this is to be performed by computer. Author (ESRO)

N70-17389*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPERATION MANUAL FOR THE MARK 1 MODEL OF THE LASER ABSOLUTE GRAVIMETER
William M. Greene and James Yarbrough 1 Aug. 1969 196 p
(NASA-TM-X-53856) Avail: CFSTI CSCL 14B

Discrepancies exist between the established Potsdam gravity values and subsequent measurements. Greater precision can be obtained by utilization of an absolute gravimeter. An absolute gravimeter using the principles of a Michelson interferometer is under development at NASA's Marshall Space Flight Center. The installation, operation, and maintenance of the Mark I (Laboratory Model) Laser Absolute Gravimeter is discussed in this document. As of this publication, the Potsdam value has now been corrected to approximately 13.8 milligals. Author

N70-17398 National Lending Library for Science and Technology, Boston Spa (England).
AN ELECTRONIC DEVICE FOR THE MONITORING OF THE VENTILATION VELOCITY IN DUCTS [EINE ELEKTRONISCHE WEBERWACHUNGSEINRICHTUNG FUER DIE WETTERGESCHWINDIGKEIT IN LUTTEN]
J. Olaf 28 Jul. 1969 7 p Transl. into ENGLISH from Glueckauf (Essen), v. 105, no. 1, 9 Jan. 1969 p 23 - 25
(NLL-SMRE-Trans-5695-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A new concept for ventilation monitoring in mines is based upon a heat-sensitive conductor element with negative temperature coefficient (thermistor). The ventilation flowing past this element cools it so that its internal resistance changes, which is measured and used for tripping circuit breakers. It is possible to connect to the thermistor a low frequency transmitter circuit and to transmit via a simple and intrinsically safe transmission lead the low frequency information signal to a receiver in the area of the intake air. The ventilation transducer consists of a brass tube of about 15 cm length in the front end of which is fitted the heat sensitive conductor. J.M.

N70-17422# Harvard Coll. Observatory, Cambridge, Mass.
SOLAR-BLIND PHOTOELECTRIC DETECTION SYSTEMS FOR SATELLITE APPLICATIONS
P. J. Macar, J. Rechavi, M. C. E. Huber, and E. M. Reeves Jul. 1969 42 p refs
(TR-9) Avail: CFSTI

Characteristics of open Magnetic Electron Multipliers (MEM) with continuous dynode and field strips are discussed in view of their use in satellite borne detection systems. Special emphasis is placed on selection, thermal stabilization, calibration, and long-time performance of the detectors. Practical aspects of the design of satellite borne detection systems, such as monitoring capabilities, immunity to charged particles, and electrical breakdown are also described. Laboratory studies with fast electronics showed that the useful linear range of a MEM is restricted, because of afterpulses. Most characteristics of MEM's reported appear to be due to the use of relatively slow electronics that did not resolve the afterpulses. Statistical studies of afterpulses are reported and a tentative explanation for the generation of afterpulses is outlined. Author

N70-17428*# Ewen Knight Corp., East Natick, Mass.
OPTIMIZATION OF MICROWAVE RADIOMETRIC SYSTEMS FOR EARTH RESOURCE SURVEYS Final Report
H. I. Ewen and A. H. Barrett Jun. 1969 177 p refs
(Contract NAS12-2047)
(NASA-CR-86316) Avail: CFSTI CSCL 14B

Passive microwave sensing projects instrumentation, and techniques are discussed. Studies and analytical models are reviewed in the areas of oceanography and marine technology, geology and hydrology, geography and cartography, and agriculture and forestry. Present ground-based and aircraft measurements are described and instrument technology requirements are analyzed. Airborne parametric displays with attendant laborious data reduction requirements and ineffective use of aircraft flight time reduce this form of data display to minimal use. Aircraft imagery techniques are considered to be not optimum. It is suggested that an experimental investigation of the potential benefits of passive remote sensing be made, utilizing more direct participation by users in the planning and execution phases. It is felt that microwave antenna size requirements are incompatible with present-day jet and piston type aircraft, but are compatible with satellites. An engineering plan is outline for the development of instrument technology, based on the building-block approach. N.E.N.

N70-17431*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF POSITIVE GAUGING SYSTEMS. PHASE 2: DESIGN AND ANALYSIS
B. Siegel, R. Rusch, R. Wolfrum, H. Lurie, S. Lieberman et al Dec. 1967 117 p
(Contract NAS9-8750)
(NASA-CR-65962; TRW-07582-6001-R000) Avail: CFSTI CSCL 14B

A feasibility study was made of an advanced storable propellant-mass gauging system capable of operating independent of propellant location or gravity field. The program was divided into two phases. The first phase consisted of a systematic study of various possible gauging systems following by analysis to establish their potential capability and feasibility. As a result, a Resonant Infrasonic Gauging System (RIGS) was selected for study in Phase 2. The second phase, which is the subject of this report, consisted of a detailef investigation of this system and included the following major objectives (1) Perform feasibility tests of the RIGS gauging concept; (2) Analytically evaluate operational and integration problems for application of RIGS to the Apollo SPS tankage; (3) Complete a prototype RIGS gauge design and evaluate system performance. All objectives were successfully accomplished. Author

N70-17573# Edinburgh Univ. (Scotland). Psychological Lab.
THE PICKFORD–NICOLSON ANOMALOSCOPE: CALIBRATION, VALIDATION AND POPULATION NORMS
R. Lakowski Aug. 1968 34 p refs Presented at 2nd Scot. Symp. on Colour, Edinburgh, 5-6 Sep. 1968
(AD-695342; Rept-42/1) Avail: CFSTI CSCL 20/6

The Pickford-Nicolson anomaloscope (P-N) is defined as a simple colorimeter where a number of colour mixture ratios can be utilised for studying both normal and defective colour vision. The instrument was designed in 1960. Calibration, validation, and population norms are discussed. Author (TAB)

N70-17622*# National Bureau of Standards, Boulder, Colo.
INFRARED REFLECTANCE MEASUREMENTS Final Report, 1 Jan. 1967 – 30 Jun. 1969
Joseph C. Richmond and Jon C. Geist 30 Jun. 1969 95 p refs
(NASA Orders R-09-022-032; L-80662)
(NASA-CR-107844; NBS-10071) Avail: CFSTI CSCL 14B

An improved version of the ellipsoidal mirror reflectometer was designed, and construction was nearly completed. The new design provides for measurements to be made in a controlled atmosphere and increases ease of operation. Tests indicated that use of a detector-scanner combined with an electronic integrator would permit measurements to be made at wavelengths out to .015mm or beyond with an overall error that should not exceed about two percent of the measured value. Operation of the ellipsoidal mirror reflectometer in the inverse mode showed definite promise of increasing the usable wavelength range substantially without loss in accuracy. Use of an interferometer spectrometer with the ellipsoidal mirror in the inverse mode appears entirely feasible. An interferometer spectrometer was used to measure reflectance of high-quality mirrors over the wavelength range of approximately .004 to .030 mm, to an accuracy of better than one percent of the measured value. A computer code was developed for reduction of interferograms. Author

N70-17642# TRI-Univ. Meson Facility, Vancouver (British Columbia).
MAGNETIC FIELD MAPPING SYSTEM: AN OPERATION AND SERVICE MANUAL
Roland W. Cobb (Victoria Univ., British Columbia) Feb. 1969 51 p
(TRI-69-3) Avail: CFSTI

An operation and maintenance manual for a magnetic field measuring system developed at the University of Victoria to study TRIUMF beam magnets is presented. The system consists of a three dimensional coordinate table, a digital voltmeter, control and readout electronics, and a Teletype equipped with paper type punch. This system provides a method of transporting a field-sensitive device (which are not described) throughout the volume of a magnetic field while obtaining a punched and typed record of positions and field readings. NSA

N70-17660# Bendix Corp., Baltimore, Md. Environmental Science Div.
DEVELOPMENT OF A LOW LEVEL SOUNDING SYSTEM Final Report, Feb. 1966 – Jul. 1968
Raymond G. Ramirez, Robert J. Betz, and James R. Colby May 1969 150 p
(Contract AF 19(628)-5117)
(AD-697086; AFCRL-69-0286; EIR-822) Avail: CFSTI CSCL 4/1

The results of a program to develop, design and fabricate a low-level telemetry subsystem to operate in the lower 1,000 meters of the atmosphere and compatibly interface with a modified Rawin Set AN/GMD-4 is presented herein. The subsystem has been designed to provide a detailed analysis of the temperature, humidity and wind structure of the lower atmosphere, employing standard radiosonde sensors and transponder techniques, and consideration has been given for the use of modular construction to facilitate updating as new techniques and equipments are developed. The telemetry device is adaptable for use as a balloonsonde designed for data acquisition on ascent, or as a rocketsonde providing data acquisition on descent, upon deployment of a parachute and a sensor mounting package. Utilized in the design of this telemetry device are: a solid state and integrated circuit commutator, with a sampling rate of one cycle per second, and a solid state microwave transmitter. The relatively high sampling rate of one every second provides a more complete synopsis of the atmospheric construction than have previous balloon borne or rocket sounding telemetry devices. Author (TAB)

N70-17676# McGill Univ. Montreal (Quebec). Mechanical Engineering Research Labs.
A TRANSIENT TECHNIQUE FOR MEASURING SKIN FRICTION USING A FLUSH-MOUNTED HEATED FILM AND ITS APPLICATION TO A WALL JET IN STILL AIR
D. E. Guitton Sep. 1969 70 p refs
(Grant DRB-G-9551-12)
(Rept-69-9) Avail: CFSTI

A skin friction measuring device is most useful when it can be calibrated in a known simple flow and then moved to the experimental flow to give the skin friction. In these experiments with a flush mounted hot film probe, a significant proportion of the total heat input leaks to the material surrounding the probe, and any slight difference, caused by a change of this material between calibration and test, can lead to gross errors in the measured skin friction. The problem is resolved by a special transient technique and is then applied to the measurement of skin friction in a wall jet in still air. The experimental evidence indicates that this flow conforms to the universal law of the wall. Author

N70-17683# Institute of Technology, Helsinki (Finland).
SIMULATION IN PHOTOGRAMMETRY
R. Pekka Malinen (Ph.D. Thesis) Jan. 1969 123 p refs
Avail: CFSTI

A photogrammetric systems model (PSM), applicable for the simulation of photogrammetric mapping, was created. The construction is based on the principles of stochastic models. The photogrammetric surveying process is divided into phases, and a certain randomness is included to the functions and the influence parameters of the various parts in the system. In the simulation of flight, pseudo-stochastic values are given to the variable such as the direction of the flight, the percentages of the coverage, the flight altitude, and the components of the tilt. The influences of

the typical distrubances of projection conditions, such as the atmospheric refraction, the radial distortion, and the dimensional changes of the film, are generated pseudo-stochastically. The simulation method following the PSM was applied to two methods of analytical photogrammetry, i.e., to a model by model strip and block adjustment, and to a rigorous least square method adjustment using photographs as basic elements. Author

N70-17751 India. Meteorological Dept., New Delhi. Instrument Div.

AUTOMATIC INSTRUMENTATION FOR TELEMETERING RAIN AND RIVER-LEVEL DATA FROM REMOTE STATIONS

S. V. Datar and P. Mohammed *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 300–306 (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

A tipping-bucket raingage which measures rainfall collected in a receiving funnel and gives electrical pulses equal in number to the millimeters of rain is described. An unmanned radio-reporting raingage station, consisting of a rainfall receiver, a rainfall recording unit, a programming and coding unit, a transmitter, and a power supply unit are also described. ESRO

N70-17760*# Honeywell, Inc., Minneapolis, Minn. Aerospace Div.

ATTITUDE-REFERENCED RADIOMETER STUDY. VOLUME 2: PRECISION RADIOMETRIC SYSTEM

John R. Thomas, John C. Carson, William R. Williamson, Lester B. Florant, Herman P. Grienel et al Aug. 1969 656 p refs
(Contract NAS1-8801)
(NASA-CR-66855) Avail: CFSTI HC $10.00/MF $0.65 CSCL 14B

This volume documents those aspects of the Attitude-Referenced Radiometer Study devoted to advancing the techniques for the design, analysis, and fabrication of applicable radiometric systems and the overall ARRS system interface. In the system interface area a technique was developed for rapid and complete identification and determination of the effects on all ARRS subsystems of varying design or performance parameters in any one subsystem. The analysis tool developed for this function is the parameter variation checklist. A comprehensive generalized radiometer analytical model was developed to be used as a tool in the design, analysis, and evaluation of those radiometer configurations applicable to the ARRS radiometer performance goals. The analytical model describes propagazion of external and internal signal, noise, and error through the radiometer and includes a description of the radiometer transfer function (spatial and temporal) signal processing, and ground data reduction. An operational Primary Calibration System concept was defined and the preliminary design of and engineering model completed. Author

N70-17782# Tata Inst. of Fundamental Research, Bombay (India).

TRANSISTORISED MULTICHANEL PULSE HEIGHT ANALYSER AND RECORDING SYSTEM FOR BALLOON BORNE COSMIC RAY TELESCOPE

S. V. Damle, M. F. D'Cunna, George Joseph, A. P. Kamat, S. B. Patankar et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 84–86 (See N70-17766 06-29)
Avail: AEC Depository Libraries

The pulse from the amplifier is gated by a command pulse to the height to time converter (HTC). The HTC produces a pulse with a constant height but width proportional to the pulse height. A one megacycle oscillator is gated by this pulse. A burst of pulses whose number is proportional to the pulse height is obtained at the output of the oscillator gating circuit. The pulses are stored in a 9 bit address scaler. Each bit of the scaler is indicated on a neon lamp. The neon lamps arranged in a row are focussed on a 35 mm film. The scaler is reset after a certain time delay compatible with the sensitivity of the film to photograph the neon signal. Once the pulse from the amplifier is passed throught the gate, it is closed until the analysis and the readout is complete. After the reset of the scaler, the gate is open and the PHA is ready for the analysis of the next pulse. The reset pulse also gives a command for the motor to advance the film for the desired amount. Author

N70-17783# Tata Inst. of Fundamental Research, Bombay (India).

SPARK CHAMBERS FOR STUDY OF COSMIC RAYS AT BALLOON ALTITUDES

P. C. Agrawal *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 87–91 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Single gap and multigap spark chambers using aluminum, brass, and lead plates and having different gap widths and sensitive areas have been constructed. In the construction of all these spark chambers perspex frames were used for insulating the adjacent plates. The perspex frames are made as a single piece out of a perspex plate which has been machined to a uniform thickness all over the surface to an accuracy of one part in a hundred. The jointless perspex frames are then polished on the sides to make them highly transparent in order to photograph sparks through them. Author

N70-17795# Physical Research Lab., Ahmedabad (India).

LARGE AREA SCINTILLATION TELESCOPES

L. V. Kargathra *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 159–161 Supported by Dept. of At. Energy (See N70-17766 06-29)
Avail: AEC Depository Libraries

Construction and operation of large area scintillating telescopes are described. These instruments measure intensities of cosmic rays arriving in vertical and inclined directions by 1000000 counts/hour and 1.8 times 100000 counts/hour, respectively. To compensate for the change of difference in optical path length, the mass of these scintillators is increased radially from centers to corners. A photomultiplier is mounted on their casings and a set of mechanical recorders provide the data. Results from a solar diurnal variation shown an amplitude of about 0.33 percent after pressure correction and a time of maximum around 1800 hours. G.G.

N70-17801# Regional Engineering Coll., Durgapur (India). Dept. of Physics.

DURGAPUR COSMIC RAY MAGNETIC SPECTROGRAPH

B. C. Nandi and M. S. Sinha *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 202–207 refs Supported by Dept. of At. Energy (See N70-17766 06-29)
Avail: AEC Depository Libraries

The development of a magnetic spectrograph for measurements of momentum spectra and muon charge ratios in the region 20 GeV/c to 1000 GeV/c is described. A cloud chamber has been prepared for operation with delayed expansion and suitable sweeping field for drop counting at maximum condensation levels. Two large solid iron magnets have been set up to create magnetic field regions. Expected maximum detectable momentum measurements on muons by this spectrograph will be nearly 1000 GeV/c if the track location error and the error due to multiple coulomb scattering in the material of the magnet is considered. G.G.

N70-17802# Regional Engineering Coll., Durgapur (India). Dept. of Physics.

DEVELOPMENT OF A BIG CLOUD CHAMBER FOR MEASURING THE SPECIFIC IONISATION OF MUONS

A. K. Das and M. S. Sinha *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 208–211 refs Supported by Dept. of At. Energy (See N70-17766 06-29)

Avail: AEC Depository Libraries

A cloud chamber with delayed expansion was set up for measuring specific ionization in the relativistic region of muons by the drop counting method. The chamber is triggered by a three-fold coincidence system counter telescope and its clearing field is removed 10 milli seconds after passage of the controlling particle. The stereoscopic camera focuses in the central plane of the chamber at an angle of 9 degrees. Sharp drop images are visible over 20 cm depth. Positive and negative ion columns obtained for passing muons in a mixture of 70 to 30 percent argon and ethyl alcohol-water vapor are shown. Droplet images on the film have a diameter of about 25 microns. G.G.

N70-17867# Tata Inst. of Fundamental Research, Bombay (India).
BUBBLE CHAMBER FILM ANALYSIS FACILITY AT TIFR
R. Raghavan and Subramanian *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 693–695 (See N70-17766 06-29)
Avail: AEC Depository Libraries

Described is the instrumentation for a bubble chamber film analysis facility that will be able to make measurements on bubble chamber pictures and processes them immediately. The equipment includes an image plane digitizer along with a projection table. The optical incremental encoder utilized has at least a count of 50 micron. An on-line computer fits the incoming data and sends typewriter messages whenever a fault is found. G.G.

N70-17955*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MINIATURE TWO-AXIS FLUXGATE MAGNETOMETER
C. J. Pellerin and M. H. Acuna (Fairchild Hiller Corp., Germantown, Md.) Washington Jan. 1970 27 p refs Presented at the Geosci. Electron. Symp. of the Inst. of Elec. and Electron. Engr., Apr. 1969
(NASA-TN-D-5325, G-944) Avail: CFSTI CSCL 14B

A miniature two-axis fluxgate magnetometer for sounding rocket applications was developed. The distinctive feature of this instrument is that it simultaneously measures, with a single sensing element, two orthogonal components of an external magnetic field. Observed performance is accurately predicted by means of a quantitative linear mathematical model. The dependence of the output voltage on several design parameters is obtained by a Fourier analysis of the output waveform. A computer-aided analysis is presented for core materials of 4-79 Mo-Permalloy and 50-50 Ni-Fe. Author

N70-17965# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
A TECHNIQUE FOR DISSECTING AND RECORDING HOLOGRAPHIC INFORMATION
P. F. Krzyzkowski, and J. J. Pucilowski Sep. 1969 11 p refs
(AD-696429; ECOM-3177) Avail: CFSTI CSCL 14/5

Techniques of optically imaging a hologram on the photocathode of a camera tube, dissecting this two-dimensional pattern into TV-type serial information for electrical transmission to another location, and reconstituting the serial information into a holographic pattern with the aid of a very-high-resolution (VHR) cathode-ray tube (CRT) at the remote location are presented. Resolution capabilities of the optical system, camera tube, and recording CRT are examined. Overall results of dissecting, transmitting, and recording from a basic 220 lp/mm transmission grating are presented and discussed. Techniques and components for an improved system are discussed with respect to the initial design approach. Author (TAB)

N70-18088# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
STABILITY OF UNIAXIAL GYROSTABILIZER WITH DRY FRICTION IN AXIS OF PRECESSION [STABILITE D'UN STABILISATEUR A UN AXE EN PRESENCE DE FROTTEMENT SEC DANS L'AXE DE PRECESSION]
N. Ya. Kogan [1969] 14 p refs In FRENCH and RUSSIAN *Its* Trans. of Higher Educational Inst. No. 12
(LRBA-69-0729) Avail: CFSTI

The stability of a single axis gyrostabilizer is analyzed taking into account the moment of dry friction in the axis of precession for occurrences when the gyrostabilizer is frictionless, stable, and neutral. It is shown that gyrostabilizer movements asymptotically approach uniform rotation around the axis of stabilization. Transl. by E.C.

N70-18098# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
COMPARISON OF DIFFERENT METHODS FOR DETERMINING THE TRANSFER FUNCTIONS OF BLACK AND WHITE AERIAL PHOTOGRAPH FILMS [COMPARAISON DE DIFFERENTES METHODES DE DETERMINATION DE LA FONCTION DE TRANSFERT DE CONTRASTE DES FILMS NOIR ET BLANC POUR PRISES DE VUES AERIENNES]
V. Ya. Mikhaylov and Ya. P. Maslenikov [1969] 10 p refs In FRENCH and RUSSIAN
(LRBA-69-0364) Avail: CFSTI

Transfer functions were determined by projection printing of the sinusoidal image and contact printing using a sensitometer. Measurements were made of all types of aerial photography films. For comparison the transfer functions for certain Orvo films were measured. It is seen that the curves obtained experimentally are located higher than those obtained by calculation. This divergence is most noticable at low frequencies. The experimental method of determining the transfer function is preferred. Transl. by H.W.

N70-18118# National Engineering Lab., Glasgow (Scotland). Machine Tools and Metrology Div.
TECHNICAL ASPECTS OF THE NEL ABSOLUTE GRATING MEASURING SYSTEM
A. Russell Oct. 1968 49 p refs
(NEL-366) Copyright. Avail: CFSTI

An 'absolute' system of measuring displacement employing optical gratings, but not involving the use of pulse-counting techniques, has been developed. Both the system as a whole and its component parts are described in detail and its advantages over other measuring systems enumerated. Information concerning several versions using radial and linear gratings to different degrees of accuracy is provided and hitherto unpublished information is made available to cover recent developments and to clarify problems which have arisen in industry. Author

N70-18190# Royal Aircraft Establishment, Farnborough (England).
A LIQUID CALORIMETER FOR THE MEASUREMENT OF LASER ENERGY
Jennifer Foster, C. Appleyard, and D. W. P. Jones Apr. 1968 32 p refs
(RAE-TM-WE-1271) Avail: CFSTI

The laser energy is absorbed in a 5.9 percent by weight aqueous solution of nickel sulfate. The instrument is designed to function over the range 10 to 300 joules. By optimizing the concentration of the liquid solution an accuracy of plus or minus 5 percent should be possible. Author

N70-18201# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL EVALUATION OF A LINEAR POLAR-DISPLAY SIGNAL ANALYZER
Norbert James Spitzer and Glen A. Myers Jul. 1969 75 p refs
(AD-696869; NPS-52MV9071A) Avail: CFSTI CSCL 14/2

The report presents the results of an experimental evaluation

of a linear, polar-display signal analyzer. Signals generated in the laboratory are used to determine the ability of the device to indicate the type of carrier modulation and the carrier parameters such as frequency, data rate, and bandwidth. Live signals in the HF band are monitored by applying the predetected output of an R-390A receiver directly to the signal analyzer. Photographs of the actual displays resulting from signals generated in the laboratory demonstrate the ability of the system to provide a distinctive display in each case. Various parameters of the input signal can be determined by measuring parameters of the display. The ability of the signal analyzer to determine the normalized autocorrelation function of a bandpass gaussian process is demonstrated. Author (TAB)

N70-18294# Lockheed Missiles and Space Co., Palo Alto, Calif.
TESTING OF A SUPERCONDUCTING MAGNETIC SYSTEM WITH A H APPROXIMATELY EQUAL TO 20 koe FIELD ON BOARD AN ARTIFICIAL EARTH SATELLITE
L. V. Anashkin et al. [1969] 10 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 7, no. 5, 1969 p 786–793
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A superconducting magnet with a magnetic field whose intensity and size permit experimentatio n on a charge and energy analysis of cosmic ray electrons is reported. Testing under actual space flight conditions is described. It is shown that storage of a coolant in a two phase, liquid gas state under weightlessness conditions is possible in cryostats with some simple adapters. For prolonged operation of superconducting apparatus onboard an artificial earth satellite, it is necessary to produce a cryostat system capable of functioning not only under weightlessness but also under vary complex, changing conditions of space flight. The cryostat system must also be adaptable to increasing quantities of coolant utilized in discharge type systems. The applicability of special superconductors or more efficient cooling methods using the space vacuum is also assured. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-18949# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.
AN APPARATUS DESIGNED TO STUDY THERMAL AND MECHANICAL FATIGUE IN METALS
A. R. Marrow Jun. 1969 15 p
(RD/B/M1366) Avail: CFSTI

Numerous power plant component failures are attributable to a combination of cyclic, thermal and mechanical stresses. This report describes the apparatus which was designed and developed. It investigated the materials deformation and failure criteria which predominate at the high strain region of 1,000 to 10,000 cycles to failure. Author

N70-18957# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE APPLICATION OF GAS REFRIGERATING MACHINE FOR THE COOLING OF THERMOCHAMBERS
L. I. Mak and I. E. Zinina 24 Mar. 1969 13 p refs Transl. into ENGLISH from Kholodilnaya Tekhn., (USSR), v. 44, no. 9, 1967 p 30–33
(AD-696605; FTD-HT-23-877-68) Avail: CFSTI CSCL 13/1

To cool temperature chambers to minus 80C and below, stages of refrigerating machines are often used, but they are complex, cumbersome, costly, and of low reliability. Tests have been made to compare vapor refrigerating machines with gas models when operating to refrigerate low-temperature chambers. The unit consists of a helium gas refrigerating machine and a temperature chamber. TAB

N70-17034*# National Aeronautics and Space Administration, Washington, D.C.
MATERIALS SCIENCE AND PROCESSING IN SPACE. APPENDIX H
W. G. Shepherd and A. R. Vernon *In its* Proc. of the Winter Study on Uses of Manned Space-Flight, 1975–1985 1969 p 163–173 refs (See N70-17026 06-34)
Avail: CFSTI CSCL 13H

The potential of new processes and materials is evaluated for technological development in space by considering relevant properties of the space environment. Among these properties considered are: gravitational field, space vacuum, and the radiation environment. It is concluded that a material laboratory would be a useful component of a space station for processing materials. Specialized materials have been identified as having unique properties that can be produced only under space conditions, and the zero-g processing will expand horizons and generate a much broader spectrum of possibilities for materials processing. F.O.S.

N70-17036# Mechanical Technology, Inc., Latham, N.Y.
DEVELOPMENT AND TEST OF LONG-LIFE, HYBRID BOOST THRUST BEARINGS FOR SMALL, HIGH-SPEED JET ENGINE APPLICATIONS
Lee W. Winn Jun. 1969 142 p refs
(Contract N00019-68-C-0269)
(AD-697008; MTI-69TR17) Avail: CFSTI CSCL 13/9

The initial stage of development of two Hybrid Boost Bearing designs, applicable to jet engines, is described in this report. This work consisted of selection of Hybrid Boost bearing components, analysis of the fluid film bearing component, analysis of the ball bearing component, calculations of the combined Hybrid-Boost-Bearing performance, design of two Hybrid-Boost-bearing configurations-one rigid and one retractable, design, manufacture and assembly of a test facility, tests of the two configurations, and comparison between predicted and actual performance of the Hybrid Boost Bearing. Author (TAB)

N70-17044 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRIC CHARACTERISTICS OF THREE-PHASE CONDUCTORS WITH COMPONENT CONDUCTORS OF ROUND, ANNULAR SECTION
G. S. Borchaninov et al. 30 Jul. 1969 13 p refs Transl. into ENGLISH from Elektrichestvo USSR (Moscow), no. 3, 1968 p 1–6
(NLL-CE-Trans-4989-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Three-phase bus-trunking of various designs with conductors and screens of round cylinder form were investigated. The electrical characteristics of the trunking were determined by a mathematical analog method, using comparisons of the complex equivalent impedance. Findings are: (1) The use of continuous insulation on the conductors in symmetrical bus-trunking permits the inter-conductor dimensions to be reduced; thus improving the electrical characteristics and reducing the power losses and the external magnetic field size. (2) The lowest power losses and smallest magnetic fields are in the trunking with paired phases. (3) Three coaxial single-phase trunks have poorer electrical characteristics than paired-phase trunking. (4) Symmetrical bus-trunking, with demountable half-screens insulated from each other, has poorer electrical characteristics than a trunk with continuous screening. D.L.G.

N70-17127# Royal Aircraft Establishment, Farnborough (England).
A COLLECTION OF SOME PAPERS ON BALL BEARING RESEARCH AT RAE FROM 1958 to 1960
W. R. Hinton May 1969 155 p refs
(RAE-TR-69088) Copyright. Avail: CFSTI

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5. A METHOD OF EXAMINING BROKEN BALL BEARINGS AND MEASURING THE AMOUNT OF ANGULAR MISALIGNMENT WHICH HAD BEEN PRESENT W. R. Hinton 16 p refs (See N70-17132 06-15)

6. A THEORETICAL STUDY OF THE EFFECT OF ANGULAR MISALIGNMENT ON BALL BEARING CAGE LIFE W. R. Hinton 22 p refs (See N70-17133 06-15)

N70-17128# Royal Aircraft Establishment, Farnborough (England).
AN INVESTIGATION INTO THE CAUSES OF BALL BEARING FAILURES IN TYPES P2 AND P3 ENGINE DRIVEN GENERATORS
W. R. Hinton *In its* A Collection of Some Papers on Ball Bearing Res. at RAE from 1958 to 1960 May 1969 59 p refs (See N70-17127 06-15)
(Rept-EL-1490) Copyright. Avail: CFSTI

A theoretical analysis is made of factors thought to affect the life of ball bearings in aircraft electrical generators, and a method is given for predicting the bearing environment from given initial dimensions and ambient conditions. This is followed by corroborative evidence obtained from RAF records and from the examination of defective generators returned by the service. A method of design of bearing assemblies is given which takes into account the inevitable scatter in component dimensions and which enables the probability of obtaining an unsatisfactory environment to be estimated. Author (ESRO)

N70-17129# Royal Aircraft Establishment, Farnborough (England).
THE EXPERIMENTAL DETERMINATION OF BALL BEARING CAGE STRESS
T. S. Crawford *In its* A Collection of Some Papers on Ball Bearing Res. at RAE from 1958 to 1960 May 1969 18 p refs (See N70-17127 06-15)
(Rept-TN-EL-159) Copyright. Avail: CFSTI

Dynamic measurements using strain gauges were made to determine the effect of shaft misalignment on cage stress. Direct static measurements of ball to track friction were also made for different interference fits of the races, and for varying degrees of misalignment. Author (ESRO)

N70-17130# Royal Aircraft Establishment, Farnborough (England).
A CODE OF PRACTICE FOR USING BALL AND ROLLER BEARINGS IN ELECTRICAL MACHINES
W. R. Hinton *In its* A Collection of Some Papers on Ball Bearing Res. at RAE from 1958 to 1960 May 1969 14 p (See N70-17127 06-15)
(Rept-TN-EL-185) Copyright. Avail: CFSTI

Recommended principles to be adopted in designing bearing arrangements for electrical machines are given, based on experience in service and upon laboratory tests. Guidance is also given on the choice of fits between shafts and bearings etc., and in the selection of the nominal diametrical clearance of the bearing. Author (ESRO)

N70-17131# Royal Aircraft Establishment, Farnborough (England).
A METHOD OF COMPARING THE ROUNDNESS OF BEARING BALLS
W. R. Hinton *In its* A Collection of Some Papers on Ball Bearing Res. at RAE from 1958 to 1960 May 1969 21 p refs (See N70-17127 06-15)
(Rept-TN-EL-152) Copyright. Avail: CFSTI

An optical method of obtaining a contour pattern of small areas on the surface of a bearing ball is described with reference to the experimental techniques. This is followed by a suggested statistical treatment of the results, since only a fraction of the total ball area can be sampled, and a numerical example is included to demonstrate the statistical tests employed. Author (ESRO)

N70-17132# Royal Aircraft Establishment, Farnborough (England).
A METHOD OF EXAMINING BROKEN BALL BEARINGS AND MEASURING THE AMOUNT OF ANGULAR MISALIGNMENT WHICH HAD BEEN PRESENT
In its A Collection of Some Papers on Ball Bearing Res. at RAE from 1958 to 1960 May 1969 16 p refs (See N70-17127 06-15)
(Rept-TN-EL-183) Copyright. Avail: CFSTI

A method of detecting evidence of misalignment is given, illustrated by photographs of rings from damaged ball bearings. Calculations of the angles of misalignment which had been present is demonstrated. Author (ESRO)

N70-17133# Royal Aircraft Establishment, Farnborough (England).
A THEORETICAL STUDY OF THE EFFECT OF ANGULAR MISALIGNMENT ON BALL BEARING CAGE LIFE
W. R. Hinton *In its* A Collection of Some Papers on Ball Bearing Res. at RAE from 1958 to 1960 May 1969 22 p refs (See N70-17127 06-15)
(Rept-TN-EL-184) Copyright. Avail: CFSTI

Characteristic curves are derived showing the maximum instantaneous speed differences between balls in angularly misaligned ball bearings of different proportions. The effect of changes in various dimensional paremeters is discussed with reference to cage life, and recommendations concerning the choice of bearings for particular applications and possible improvements are made. Author (ESRO)

N70-17160# Columbia Univ., New York. Lubrication Research Lab.
COMPLIANT SURFACE BEARINGS: AN ANALYTIC INVESTIGATION
Milton K. Benjamin 1 Aug. 1969 180 p refs
(Contract Nonr-4259(06))
(AD-696662; TR-15) Avail: CFSTI CSCL 13/9

The problem investigated is that of compliant surface bearings. An analytic and numerical representation is developed and applied to the geometries of the axisymmetric thrust bearing and journal bearing. In the case of the thrust bearing numerical results and experimental data are compared indicating the need for further investigation. In the case of the journal bearing numerical results are presented. In general, the elastomer is represented by linear elasticity and the fluid by Reynolds equation. Author (TAB)

N70-17215# Technische Hogeschool, Delft (Netherlands). Lab. voor Energievoorziening en Kernreactoren.
CLASSIFICATION OF CALCULATION METHODS FOR FLANGE CONNECTIONS UNDER STATIC CONDITIONS [CLASSIFICATIE VAN BEREKENINGSMETHODEN VOOR FLENSVERBINDINGEN ONDER STATISCHE OMSTANDIGHEDEN]

D. H. van Campen Nov. 1968 48 p refs In DUTCH
(WTHD-9; TH-D-KR-139) Avail: CFSTI

This literature classification of calculation methods for flanged connections under static conditions encorporates critical descriptions of these calculation methods. The study covers fixed ring flanges contingent with conic necks and fastened to a circular cylindrical shell. All calculation methods are presented in a simplified manner and give detailed descriptions of arbitrary rotating shell fastened flanges as well as of unloaded flanges. The two main calculation methods for flange connections are based on the theories of elasticity and plasticity; each contain two subgroups that evaluate the flange ring as either a ring plate or as a diametrically undeformable tilt ring. It is shown that the problem of calculating the strength of flange connections depends on the following: (1) stipulation of connection work under external loads; and (2) calculation of developing deformation stress with the help of stipulated external load factors. Transl. by G.G.

N70-17234# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.
THE DESIGN OF FLUSH CYLINDER/CYLINDER INTERSECTIONS TO WITHSTAND INTERNAL PRESSURE
H. A. Money Feb. 1968 25 p refs
(RD/B/N1061) Avail: CFSTI

The reasons for wanting to modify the current pressure vessel codes are discussed and the limitations of the current codes are examined. A new method of predicting nozzle thickness based upon experiment is presented. This leads to thinner nozzles where the radius ratio is small and slightly thicker nozzles where the radius ratio approaches unity. Author

N70-17321# National Engineering Lab., Glasgow (Scotland). Materials Group.
AN INTERMITTENT (SEMI-CONTINUOUS) HYDROSTATIC EXTRUSION MACHINE
H. Li. D. Pugh Feb. 1968 11 p refs
(NEL-344) Copyright. Avail: CFSTI

A brief description is given of a machine capable of carrying out intermittent (semi-continuous) hydrostatic extrusion. The detailed description is given for the intermittent extrusion of a non-flexible billet giving a non-flexible product. The machine can be modified to carry out intermittent extrusion of non-flexible billets into a flexible product and to the case of the extrusion of a flexible billet into a flexible product and these modifications are briefly given. Author

N70-17328 National Lending Library for Science and Technology, Boston Spa (England).
THE TRANSPORT PROCESS IN THE ENTRANCE ZONE OF AN EXTRUDER
K. Schneider [1969] 23 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (Weinheim), v. 41, no. 5/6, 1969 p 364–369
(NLL-M-7747-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Equations are derived which enable the throughput, pressure buildup, and power requirements in the solid region to be calculated when the friction properties and the pressure distribution of the plastic granules are known. Transport properties in this region are determined by the frictional effects of the granular materials against the screw and the cylinder. It is shown that the throughput depends on the R.P.M., transport angle, and geometry of the screw. Experimental and theoretical data are compared for the relationship of throughput to back pressure. J.M.C.

N70-17351*# Mechanical Technology, Inc., Latham, N.Y.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF GAS BEARING TILTING PAD PIVOTS Final Report
M. B. Peterson, S. F. Geren, E. B. Arwas, S. Gray, S. F. Murray et al Sep. 1969 300 p refs
(Contract NAS3-7629)
(NASA-CR-72609; MTI-69-TR-32) Avail: CFSTI CSCL 13I

An analytical and experimental investigation was conducted to determine the extent of fretting damage in gas bearing tilting pad pivots. Analytical investigations were conducted to determine the amount of motion to be expected in a typical pivot, the amount of microslip in the contact area, and the pivot shape for minimum microslip. Experimental investigations were conducted to determine the effect of material, pivot shapes, frequency, load, amplitude, time, and temperature on pivot damage and wear. It was found that with M-series tool steels and titanium carbide cermets wear and damage could be prevented over a wide variety of conditions. Author

N70-17357*# New Hampshire Univ., Durham. Dept. of Mechanical Engineering.
HIGH SPEED-HIGH FLOW PUMPING SYSTEMS Final Report
J. A. Wilson 1 Sep. 1969 46 p refs
(Contract NAS12-2141)
(NASA-CR-86319) Avail: CFSTI CSCL 13K

This study attempts to identify some promising variations or new ideas and to give them some evaluation. The vapor core pump holds much promise as a high speed main pump capable of handling turn down ratios encountered in aircraft applications and suitable for direct drive by high speed electric motors. The decrease in power requirements over recirculation of excess flow is a substantial benefit. The size and weight requirements over the gear pump are considerable especially in the higher flow ranges. Of any method in the developmental process today the vapor core main pump would seem most promising and deserving of continued development. High speed centrifugal pumps whether conventional or full running vapor core will require high net positive suction head (NPSH). The combination of jet induced preswirl used in conjunction with boost impellers or inducers is one way by which additional heads can be developed by boost stages in addition to providing a means of reducing recirculation flow at turn down conditions. Reduced or off design flow rate handling capability has been significantly improved by use of preswirling techniques. The value of less recirculated flow at reduced flow rates will increase with higher pressure boost stages. Author

N70-17368*# Martin Marietta Corp., Denver, Colo.
CLEANLINESS LEVEL REQUIREMENTS FOR PNEUMATIC AND HYDRAULIC COMPONENTS: SERVICE ARM SYSTEMS, COMPLEX 39 Final Report
Sep. 1969 363 p refs
(Contract NAS10-5935)
(NASA-CR-107216; MCR-69-484) Avail: CFSTI CSCL 13G

Both an analytical and experimental effort is described to determine the minimum cleanliness levels required for the pneumatic and hydraulic systems on the Launch Complex 39 Service Arms. The study encompassed an in-depth system review, a critical analysis of components with respect to contamination, a literature industry search to compile pertinent data and experience, and a test program to demonstrate component functional compliance versus contamination. Author

N70-17508# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE MECHANICAL FORCE OF REPULSION IN A SINGLE SYSTEM WITH PERMANENT MAGNETS
V. V. Kozorez *In its* Electromagnetic Processes in Converting Devices 1967 p 203–207 refs In RUSSIAN (See N70-17478 08-09)
Avail: CFSTI

The plane problem of determining the repulsive force is studied as a function of the existing mechanical coordinate for a single system with permanent magnets. It is shown that such a system can be used for bearings using permanent magnets. Transl. by H.W.

N70-17609# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
A SUSPENSION DEVICE USING A STATIONARY MAGNETIC FIELD
L. Z. Piven *In its* Electromagnetic Processes in Converting Devices 1967 p 208–210 in RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The design of an axisymmetrical magnetic suspension device is considered and the electrical circuit of its stabilizer is given. Transl. by H.W.

N70-17610# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
EXPERIMENTAL DETERMINATION OF THE METACENTER OF AN AXISYMMETRICAL MAGNETIC SUSPENSION DEVICE
L. Z. Piven *In its* Electromagnetic Processes in Converting Devices 1967 p 211–216 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The metacentric height of a magnetic suspension device can be calculated from the angle of inclination and the displacement of the center of gravity of the suspended body. Experiments were conducted on four types of ferromagnetic bodies: a cone, a cupola, a spherical segment, and a semi-sphere. Transl. by R.B.

N70-17607*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BOLT TORQUE TESTS IN VACUUM
Keith E. Demorest 10 Oct. 1969 16 p
(NASA-TM-X-53936) Avail: CFSTI CSCL 13H

Test equipment and tests made to determine the effects of a vacuum environment on the release torque of various threaded fastener materials both lubricated and unlubricated is presented. Results show the lowest release torques were obtained with steel bolts using an inorganically bonded dry film lubricant in vacuum while the highest release torques occurred with unlubricated steel fasteners in air. Author

N70-17616# National Engineering Lab., Glasgow (Scotland).
TRIBOLOGY AT NEL
R. B. Campbell and H. L. Wunsch Jan. 1969 25 p ref
(NEL-382) Copyright. Avail: CFSTI

Work on the design and testing of bearings and on the measurement of wear is summarized. The report indicates areas of Tribology in which the National Laboratory can assist in solving industrial problems. Author

N70-17663# National Engineering Lab., Glasgow (Scotland).
A PRELIMINARY REPORT ON THE EFFECT OF APERTURE SHAPE IN COLD EXTRUSION OF STEEL
M. T. Watkins, J. Mc Kenzie, and E. Whitfield Jan. 1969 33 p refs
(NEL-383) Copyright. Avail: CFSTI

Earlier studies of cold extrusion of steel concerned the extrusion of billets into products of circular cross-section. Results are now reported of an investigation into the effect of aperture shape in the forward extrusion of rod and of punch shape in the backward extrusion of can. For the range of shapes considered the pressures required were within 10 percent of those for the extrusion of circular products of the same cross-sectional area, i.e., at the same extrusion ratios. Author

N70-17679*# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
DYNAMIC ANALYSIS OF A THREE-FOIL ROTOR SUPPORT SYSTEM IN ZERO GRAVITY ENVIRONMENT
A. Eshel 1 Sep. 1969 78 p refs
(Contract NASw-1456; Nonr-3815(00) (X))
(NASA-CR-107901; RR-69-12) Avail: CFSTI CSCL 13I

The dynamic and static behavior of a gas lubricated bearing, consisting of streched foil sectors, is analyzed. General equations describing the fluid film and valid for shaft excursions of the order of the clearance, are derived on the basis of planar motion and neglibible fluid inertia. The analysis is then specialized to the case of a bearing consisting of three equally spaced foil sectors. For the static equilibrium condition, tensions and gaps are calculated and graphs are presented. For the dynamic case, the basic equations are linearized, and equations for the in-and out-of-phase steady-state response to sinusoidal excitation are derived. This serves as an illustration of foil-bearing dynamic behavior as well as for stability investigation. For the case of zero radial load, the effects of speed, rotor radius, foil thickness, wrap angle and initial tension on the coefficients of damping and stiffness are graphically presented. Author

N70-17685# Central Mechanical Engineering Research Inst., Durgapur (India)
DESIGN AND DEVELOPMENT OF CREEP TESTING EQUIPMENT
C. S. Kholia Jun. 1969 16 p refs
(CMERI-A22) Avail: CFSTI

An account is given of the design and performance of a 3000 kg tensile creep testing machine developed at CMERI together with the details of the furnace and strain measuring extensometer also developed. An important feature of the design of the creep testing equipment is that it can be used for provision of design data as well as for fundamental research on the mechanism of creep. Author

N70-17722# Central Mechanical Engineering Research Inst., Durgapur (India).
ELECTRONIC SPARK IGNITION FOR AUTOMOBILE ENGINES
A. Das Sharma and T. Singh May 1969 26 p refs
(CMERI-A21) Avail: CFSTI

Efficiency of an automobile IC engine depends to a large extent upon the performance of the spark ignition system. But the ignition system presently in use, fails short of the desired performance in several aspects. It is worthwhile to mention here that the inherent disadvantages of the conventional ignition system could not be overcome until the high voltage switching semiconductor devices were introduced. In 1962, it was first reported that some of the disadvantages of the existing battery coil ignition system could be eliminated by the use of transistor as switching device in the ignition circuit. This subsequently led to the development of an improved system where a charged condenser is discharged through a thyristor. A comparative study is made of the conventional and electronic systems, and in details the working principle and build up technique for a capacitor discharge type spark ignition system is described. Author

N70-17781*# General Dynamics/Convair, San Diego, Calif.
RESISTANCE WELD MONITORING CENTAUR TANKS 55-0601-22, 55-0601-23 (AC-21; AC-22) Final Report
F. J. Wiegand Mar. 1969 28 p ref
(Contract NAS3-11811)
(NASA-CR-107903; GDC-AGD-69-0028) Avail: CFSTI CSCL 13H

Two in-process methods of determining weld quality were evaluated under actual production conditions in this program. The ultrasonic method using ultrasonic transducers installed in the welding electrodes, whereby the through transmitted sound is monitored for the effect produced by each weld cycle. The thermal expension method, which measures the rate of expension produced by each weld. Both of these methods were used to monitor actual production welding of Centaur Tanks AC-21 and AC-22. The results are compared with X-rays to determine correlation. Results obtained on AC-22 and final recommendations are made. Author

N70-17782*# General Dynamics/Convair, San Diego, Calif.
RESISTANCE WELD MONITORING CENTAUR TANKS 55-0501-22, 55-0501-23 (AC-21, A-22) Preliminary Report
Frank J. Wiegand Nov. 1968 41 p
(Contract NAS3-8711)
(NASA-CR-107883; GDC-AGD-68-002A) Avail: CFSTI CSCL 13H

Two in-process methods of determining the quality of resistance welds were evaluated in this program: (1) the ultrasonic method which utilizes piezo-electric transducers installed in the welding electrodes, and which monitors the effects upon the transmitted sound produced by the weld cycle; and 2) the thermal expansion method, which measures the rate of expansion produced by each weld. Both of these methods were used to monitor actual production welding of Centaur Tank AC-21. The results were compared with X-ray to determine correlation. Problems encountered during weld monitoring are discussed and preliminary results are given. Author

N70-17904# College of Aeronautics, Cranfield (England).
INCREMENTAL CONTROL
A. L. Watson and D. W. Mc Que Jun. 1969 18 p refs
(CoA-Note-m/P-22) Avail: CFSTI

The control of a center lathe using stepping motors and a small computer is described. The mechanical conversion is low cost and the system described is readily adaptable to the simultaneous control of a group of machine tools. Author

N70-17926 Society of Plastic Engineers, Inc., Stanford, Conn.
CUSTOM AND CAPTIVE MOLDING Technical Papers
1969 111 p ref Held at New Haven, 3–4 Dec. 1969
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17. FINANCING AND LEASING: TODAY AND TOMORROW D. G. Lindsay (CIT Leasing Corp.) p 94–99 (See N70-17943 06-34)

18. LOADING AND COLORING PLASTICS FOR CUSTOM AND CAPTIVE PROCESSORS J. C. Reib (Consir, Inc.) p 100–108 (See N70-17944 06-15)

N70-17927 Waterbury Companies, Inc., Conn.
SELECTION OF MACHINERY
Russell A. Marcy *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 1–3 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

A logical approach to the selection of equipment, tooling, and machinery is discussed. Some recommended guidelines that should be considered before making decisions in the selection of machinery are: (1) specific definition of the business in which the activity is engaged; (2) nature of the markets in which the product is being sold; (3) nature of the markets, the requirements, volume requirements, pricing schedules, dimensional tolerances, and the level of quality demanded; and (4) the scope and complexity of the items, products, or services being marketed. F.O.S.

N70-17928 ABA Tool and Die Co., Inc., Manchester, Conn.
MOLD ENGINEERING
Samuel D. Pierson *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 4–7 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The requirement of small compact captive and custom molds, containing very few cavities, capable of running for months with a minimum of attention, and built to gauge tolerances resulted in molds of hardened steel throughout. The optically controlled jig borer, and the electric discharge machine are considered essential to machining hardened steel molds. Specialization in mold building is recommended for the organization of facilities into a few groups of similar machines, working to full capacity, and utilizing the skills of the toolmakers to the maximum. F.O.S.

N70-17929 Nicholson File Co., Providence, R.I. Danco Div.
MOLDING PLANT ENGINEERING
Samuel J. Roberts *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 8–10 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The organization of the engineering department to provide optimum effectiveness in design and production of molds is discussed. The engineer categories are: production, testing, manufacturing, industrial, and estimation. The responsibilities of each of these categories are also discussed. It is recommended that the head of the engineering department be included in management decisions. F.O.S.

N70-17930 Premix, Inc., North Kingsville, Ohio.
ESTIMATING MOLDING PARTS COSTS
Chester L. Ward *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 11–25 (See N70-17926 06-15)
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The preparation of an estimate of molding parts costs is presented in the following steps: (1) product design, including material specification; (2) determination of part weight; (3) determination of molding and finishing equipment, labor required, production cycles and rate for each; (4) preparation of a bid sheet summarizing material, labor and equipment costs and related overhead compounding factors such as rejects, general sales,

administrative costs, profit and quantity differentials; and (5) mold cost estimation. Each of these steps is discussed, and sample cost estimates are included. It is concluded that cost estimating can be simplified for reducing preparation time and reducing chance of error, but the broadly inclusive rates must be carefully developed from accurately detailed historical and accounting data. F.O.S.

N70-17931 VCA, Inc., New York
DEBUGGING THE NEW MOLD
Donald F. Augat *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 26–30 (See N70-17926 06-15)
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An outline for debugging a tool from part design to production is given. Items that have to be defined specifically in relation to part design, tool design, and testing stages are discussed. It is concluded that debugging a tool starts at the part design stage and continues until the mold is in production.. F.O.S.

N70-17932 Ford Motor Co., Saline, Mich. Saline Plant.
CAPTIVE MOLDING ENGINEERING PROBLEMS
Jonathan L. Adams *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 31–38 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The problems are described that must be overcome in the design and engineering of a large captive molding operation including the business and economic considerations conducive to a profitable operation, and the technical, economic and administrative function of the plastics engineer. Problems discussed are: economic considerations, supply, future growth potential, and personnel. The organization, plastics processing, manufacturing engineering department, and testing are also described. F.O.S.

N70-17933 Nylon Products Corp., Clinton, Mass.
THE PLASTIC ENGINEER'S ROLE IN THE SURVIVAL OF CUSTOM MOLDING
Gordon B. Lankton *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 39–41 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The survival of firms in custom injection molding is discussed. The requirements for survival relative to the plastics engineer are considered to be: (1) specialization within the field of plastic engineering, (2) constant innovation and improvement, (3) development of momentum in progress, (4) development of intimate familiarity with molds, (5) evaluate product design, (6) develop practical familiarity with materials, and (7) understand variables of the molding process. F.O.S.

N70-17934 Miller (Theodore T.), Boston, Mass.
A CONSULTANT'S CONTRIBUTION IN MOLDING
Theodore T. Miller *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 42–48 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The question of buying or making plastic items for resale is considered in terms of the technical risks of failure versus the advantages of secrecy of product design, and speed in making. Recommended is the utilization of a consultant molder: to answer the technical problems of production, processing, material, equipment, and plant; and for solving the commercial problems of cooperate planning, cooperate finance, personnel planning, marketing, and manufacturing. It is concluded that a good relationship with a good consultant is like adding another dimension to the decision making capability of the firm. F.O.S.

N70-17935 General Electric Co., Philadelphia, Pa.
CUSTOM VERSUS CAPTIVE MOLDING
Harold D. Jost *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 51–56 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

A discussion of custom and captive molding is presented. The custom molder is considered a specialist concentrating on molding, while the captive molder is usually an adjunct to a much larger and different kind of operation. The problems facing the survival of the custom molder are listed as: complexity of automatic equipment, new materials, new trends, and personnel. F.O.S.

N70-17936 Little (Arthur D.), Inc., Cambridge, Mass.
TAILORING YOUR OWN MATERIALS
George E. Pickering *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 57–62 (See N70-17926 06-15)
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In-plant compounding of plastic molding materials is discussed. Some aspects of the mixing process are given: additive mixing of colors, powder processing of resins, mixing equipment, thermoplastic compounds, polyester premixes, and densifying. It is concluded that a decision to tailor the in-plant materials depends on the available volume, cost of compounding, and on the fabricator's desire, and capability to create unique products by creating unique raw materials. F.O.S.

N70-17937 Husky Mfg. and Tool Works, Bolton (Ontario).
AUTOMATING THE MOLDING PLANT
D. C. Cook *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 63–68 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The areas of operation that can be mechanized in a molding plant for cost reduction are discussed. These areas are: raw material handling, machines, mold, product handling, secondary hand operations, and finished product handling. Other areas such as plant layout, machines or molds, and preventive maintenance which simplify mechanization are also discussed. F.O.S.

N70-17938 Lakeville Precision Molding, Inc., Conn.
MOLDING CLOSE TOLERANCE PARTS
Richard M. Bell *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 69–71 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The precision molding of heat and chemical resistant plastics of high tensile strength is discussed. A typical molded assembly of a miniaturized elapsed time indicator is analyzed. F.O.S.

N70-17939 G-W Plastic Engineers, Inc., Bethel, Vt.
QUALITY CONTROL IN PRECISION PLASTIC MANUFACTURING
L. W. Roberts *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 72–79 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The quality control in the thermoplastic or injection molding field as applied to the comstom molder is discussed. The areas in which quality control is recommended are: control of raw materials, design and manufacture of precision dies, molding operations, quality assurance procedures, evaluation of quality results, and changes in manufacturing based on quality control. F.O.S.

N70-17940 Foster Grant Co., Inc., Leominster, Mass.
HOW ENGINEERING JUDGMENTS AFFECT COSTS
Robert P. Weiss *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 80–83 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The values and responsibilities of the plastics engineer are discussed as he effects the costs of processing equipment, processes, and the secondary operations. It is recommended that the talents of the plastic engineer be utilized by all plants involved in plastics processing. F.O.S.

N70-17941 Hoffer Plastics Corp., South Elgin, Ill.
AN ACCOUNTING PROCEDURE: KEY TO PROFIT
Robert A. Hoffer *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 84–87 (See N70-17926 06-15)

Copyright. Avail: Issuing Activity

Accounting procedures are presented applicable to custom molding operation at a 20% profit before taxes. Cost factors that must be considered are: machine hour costs, sales, administrative, donations, supplies, salaries, and labor. A sample control sheet for a 12-machine plant is analyzed. It is concluded that the net molding approach for profit control relates to productivity. F.O.S.

N70-17942 Container Corp. of America, Addison, Ill. Plastics Div.
USING MACHINE HOUR RATES IN THE MAKE OR BUY DECISION
Edward G. Slachter *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 88–93 ref (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

The principles of machine hour rate costing procedures are reviewed. It is shown that the total cost of manufacturing a plastic part includes all the overhead, and because these costs are difficult to relate to specific products, the predetermined hourly machine cost is commonly used. A sample machine hour rate determination is included. F.O.S.

N70-17944 Convair, Inc., Franklin, Pa.
LOADING AND COLORING PLASTICS FOR CUSTOM AND CAPTIVE PROCESSORS
John C. Reib *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 100–106 (See N70-17926 06-15)
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The automation of material loading, coloring, preheating, drying, storage, and scrap use in molding processes is studied for achieving cost reduction. The automation of bulk systems results is significant savings in costs, and also results in better quality control. F.O.S.

N70-18056# National Engineering Lab., Glasgow (Scotland). Formation Div.
THE USE OF A FLOATING-CHAMBER IN FORWARD AND BACKWARD EXTRUSION
E. Whitfield Jan. 1969 22 p refs
(NEL-380) Copyright. Avail: CFSTI

A preliminary investigation was undertaken to ascertain the feasibility of using a floating chamber between two opposed punches during the simultaneous forward and backward extrusion of can with can, and the single forward and backward extrusion of can. The results obtained showed that the flow of metal during combined extrusion using the floating chamber was unpredictable. The maximum extrusion pressures and the extrusion pressure/residual length of billet characteristics for combined forward and backward extrusion of can with can, using the floating chamber method, were the same as those obtained using the conventional tooling arrangement. The maximum pressures and extrusion pressure/residual length characteristics for the single forward and backward extrusion of can, using the floating chamber, were considerably lower than those using the conventional tooling. In some of the tests a part of the billet was deformed outside the chamber. Author

N70-18269*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CLOSED-CIRCUIT TELEVISION ARC GUIDANCE ADAPTER KIT FOR A COMPUTERIZED WELDING SKATE, PHASE 1
K. W. Heimendinger Sep. 1969 32 p refs
(Contract NAS8-24638)
(NASA-CR-102386; HREC-24638; LMSC/HREC-D149188) Avail: CFSTI CSCL 13H

Preliminary design features of the closed-circuit television arc guidance adapter kit and its four subsystems are described. These are: (1) an illumination head, (2) viewing optics and illuminators, (3) a proximity control system, and (4) the wire-feed mechanism. Developed to integrate with the computerized welding skate system for welding contoured surfaces, the adapter kit is capable of maintaining the illuminators in constant proximity to the work surface while following a 6-inch minimum weld radius at a maximum welding speed of 30 inches per minute. A single fiberscope bundle, in a very flexible covering, is used to interface the objective lens mounted on the illumination head to the closed-circuit television camera mounted on the skate. The design is recommended as the basis for the final design. M.R.E

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-17049# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
PROPERTIES OF GAS LASERS Final Report, 1 Apr. 1968–31 Aug. 1969
John R. Holmes 29 Oct. 1969 4 p refs
(Grant AF-AFOSR-1386-68A)
(AD-697091; AFOSR-69-2756TR) Avail: CFSTI CSCL 20/5

A brief review is given of a research project to apply gas lasers to the measurement of atomic parameters. The parameters were Einstein coefficients of Neon and Helium and cross-sections for collisions of the second kind. Author (TAB)

N70-17068# Oregon Univ., Portland. Graduate Center for Study and Research.
MULTIWAVELENGTH LASER PROPAGATION STUDY, 2 Quarterly Progress Report 15 Jun.–15 Sep. 1969
J. Richard Kerr Oct. 1969 33 p refs
(Contract N00014-68-A-0461-0001)
(AD-696134; Rept-1154-5; QPR-1) Avail: CFSTI CSCL 20/6

The objective of this program is to experimentally investigate simultaneous multiwavelength optical and infrared propagation through a turbulent atmosphere, in order to answer certain fundamental questions pertaining to the wavelength-dependence of scintillation. The experimental system is now fully operational in its improved form, and permits the simultaneous measurement of a number of statistical scintillation quantities at 4880A, 1.15 micrometers, and 10.6 micrometers, with direct, real-time recording of the results. The system is operated over a one-mile, uniform path, and utilizes very-large-dynamic-range electronics and low-noise lasers and detectors. A separate, nonoptical thermal instrument has been developed to provide an independent measure of turbulence characteristics. Preliminary results show that the infrared scintillations are log normally distributed, and suggest the possibility that saturated variances are proportional to the 7/6-power of the wavenumber, so that 10.6 micrometers radiation will saturate at a relatively low variance. Author (TAB)

N70-17197# Westinghouse Research Labs., Pittsburgh, Pa.
OPTICAL PUMPING OF LASERS Quarterly Technical Report, 1 Jul.–31 Sep. 1969
Lyle H. Taylor, Irving Liberman, Richard Liebermann, and Lloyd Armstrong, Jr. 31 Oct. 1969 59 p refs
(Contract N00014-69-C-0428; ARPA Order 1312)
(AD-697009; Rept-69-9C1-SOOPL-R1; QTR-1) Avail: CFSTI CSCL 20/5

The calculated and measured emission spectra of a 40-amp-2.5 atmosphere xenon arc discharge are compared. The measured and calculated line spectra agree with each other to within the accuracy of each spectrum whereas the measured and calculated continuum spectra differ by 100%. Five trial power series expansions have been selected for the parameter fitting (PF) method. In PF the radial wave function is given by a power series expansion with

adjustable parameters. These fitting parameters are then adjusted to reproduce the known Slater integrals. Author (TAB)

N70-17210# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
RELAXATION MECHANISMS AND GAS LASER MEDIA Final Scientific Report
William R. Bennett, Jr. Jun. 1969 9 p refs
(Grant AF-AFOSR-626-67)
(AD-696651; AFOSR-69-1616TR) Avail: CFSTI CSCL 20/5

General experimental methods were developed for the study of relaxation rates, production of population inversions in gases and the study of line broadening processes in gas lasers. These methods were applied to a large number of laser transitions in the neutral and singly-ionized noble gases and metal vapor atoms. A number of important new gas laser species were developed during the course of this research including the pulsed and cw argon ion laser transitions in the blue-green visible spectrum and a variety of pulsed and cw transitions in the yellow and red spectrum of singly-ionized zinc. The argon ion laser transitions discovered in this work still constitute the strongest available source or single-mode coherent radiation in the visible. The zinc ion laser transitions we have recently discovered illustrate the practicability of a new method of laser excitation based on charge exchange collisions in gas discharges. The latter method requires much lower threshold currents than conventional ion laser systems and offers the possibility of improved efficiency. A number of new experimental techniques were developed in the course of this research which are based on digital methods of data acquisition and analysis. These methods have permitted order-of-magnitude improvement in accuracy and sensitivity over conventional methods of approach to the same problems. Author (TAB)

N70-17455*# Hewlett-Packard Co., Beverly, Mass. Frequency and Time Div.
ATOMIC HYDROGEN MASER FOR SPACE VEHICLE APPLICATION, PHASE 2 Final Report
R. F. C. Vessot Jul. 1969 75 p
(Contract NASw-1337)
(NASA-CR-107850) Avail: CFSTI CSCL 20E

Investigation of wall coatings for hydrogen maser bulb and the building and testing of a transistor oscillator exciter is presented. The mechanical and thermal design of the maser is evaluated for improved cavity materials. Breadboard models of Breadboard flight hardware models of the thermal and pressure controllers, phase lock system, and dissociator excitor were built. Author

N70-17468# Environmental Science Services Administration, Boulder, Colo. Wave Propagation Lab.
MEASUREMENTS OF LASER BEAM SPREAD AND CURVATURE OVER NEAR-HORIZONTAL ATMOSPHERIC PATHS
G. R. Ochs and R. S. Lawrence Feb. 1969 21 p refs
(ESSA-TR-ERL-106-WPL-6) Avail: SOD $0.30

Beam curvature and beam spread have been measured with a 0.63-micrometers wavelength beam over paths 5.5, 15, 45, and 145 km long along the eastern foothills of the Rocky Mountains. The paths vary from a nearly uniform 50 m above ground for the shortest path to a slant height above ground increasing from 50 to 1700 m for the longest path. Except for the 145-km path, measurements were made continuously over several days or more. The measured beamwidth referred to the transmitter varies from as small as 5 microrad (the theoretical half-intensity beamwidth) to 150 microrad, varying more with time of day than length of path. Beam curvature is less than 0.4 microrad/100 m in the horizontal direction but varies diurnally in the vertical by as much as 4 microrad/100 m. Author

N70-17545# Stanford Univ., Calif. Microwave Lab.
METHODS FOR OBTAINING LASER ACTION AT WAVELENGTHS SHORTER THAN 3000 ANGSTROM Semi-annual Status Report 1 Mar. – 31 Aug. 1969
R. H. Pantell Sep. 1969 12 p refs
(Contract N00014-67-A-0112)
(AD-696136; ML-1790) Avail: CFSTI CSCL 20/5

There are many reasons why it would be desirable to develop lasers in the ultraviolet and X-ray regions of the spectrum. Possible applications include fluorescence studies and devices, short wavelength holography, band structure studies in solids, atomic and molecular spectroscopy, biological research, medical applications, X-ray transmission, and high energy physics research. Unfortunately, as frequency increases it becomes progressively more difficult to achieve laser action by the standard process of population inversion. The reason for the difficulty is that with a given pump power density the gain at the laser wavelength decreases rapidly with increasing frequency. Thus, it is desirable to investigate other methods for achieving coherent stimulated emission at short wavelengths. Two techniques are being investigated which are applicable to short wavelength laser action. The first is two-step laser action. The second is a tunable Cerenkov laser. Author (TAB)

N70-17961# Naval Research Lab., Washington, D.C.
A HIGH SPEED OPTICAL SHUTTER FOR FORMING A LASER EMISSION PULSE [BYSTRODEISTVUYUSHCHII OPTICHESKII ZATVOR DLYA FORMIROVANIYA IMPULSA IZLUCHENIYA OPTICHESKOGO KVANTOVOGO GENERATORA]
V. A. Gribkov, G. V. Sklizkov, S. I. Fedotov, and A. S. Shikhnov 15 Oct. 1969 22 p refs Transl. into ENGLISH from the Preprint Fiz. Inst. Akad. Nauk SSSR (Moscow), no. 53, 1969 39 p refs
(AD-696907; NRL-TRANS-1190) Avail: CFSTI CSCL 20/5

The paper reports on studies on the spatial uniformity and time characteristics of the Kerr cell. It analyzes the optimal construction and electrical parameters of a Kerr cell designed to form light pulses with minimal rise time. The analysis shows it is possible to build a shutter giving a series of light pulses of approximately 10 to the - 11th power sec duration. A Kerr cell with which a light monopulse of 0.4-nsec duration can be obtained is described. Ruby laser light of such duration was used in a design for seven-frame shadow photography of high-speed processes. Author (TAB)

N70-18014# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
CONFERENCE ON QUANTUM ELECTRONICS
Jan Blabla Jun. 1969 5 p Transl. into ENGLISH from Cesk. Casopis Fys. (Prague), v. 18, 1968 p 471 – 472 Held at Yerevan, Czech., 18 – 20 Oct. 1967 Sponsored by MIT, Lincoln Lab.
(Rept-93-69-148-Cdll) Avail: CFSTI

Theoretical and experimental studies presented at the conference covered various aspects of gas and crystal lasers, lasers with glass matrices, and problems of their operation and applications. Properties of various types of resonators for single mode operation of He-Ne lasers were evaluated and the use of profiled mirrors in gas lasers explored. Filtration of one transverse mode, width of the "hole", form of the inhomogeneously propagated spectral line of neon transition for a wavelength of 0.63 micro m, nature of circular lasers, coherence of the emerging beam, fluctuation of generated radiation, and statistical characteristics of generated photons were described for gas laser mechanisms. Special attention was given to the use of lasers in holography. A number of presentations depicted the more conventional problems of solid state lasers as well as theoretical quantum electronics. G.G.

N70-18129*# ADCOM, Inc., Cambridge, Mass.
OPTICAL ALTIMETER RECEIVER SYSTEMS STUDY AND DESIGN FOR A SPACEBORNE LASER ALTIMETER
Howard C. Selwen, Herbert G. Coles, and David R. Torrealba Washington NASA Feb. 1970 63 p refs

(Contract NAS12-2058)
(NASA-CR-1521) Avail: CFSTI CSCL 20E

The complete design and specifications for an optical altimeter receiver were studied. The system consists of a satellite borne laser transmitter and receiver oriented such that the transmitted beam is normal to the earth's surface. System parameters and design characteristics which are considered include: (1) tracking loop compensation implementations, (2) loop noise bandwith, (3) rate-aiding requirements, (4) loop acquisition characteristic, and (5) special loop stability consideration. It is concluded that an optical MSL Altimeter employing a mode-locked loop receiver tracking system is feasible. F.O.S.

N70-18193 Purdue Univ., Lafayette, Ind.
LASER INVESTIGATION OF PHYSICALLY ADSORBED GASEOUS CRYODEPOSITS
Tony Ray Brown (Ph.D. Thesis) 1968 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-7425

The technique consists of irradiating the vacuum-cryodeposit interface, the cryodeposit, and the cryodeposit-cryosurface interface with a 6328A Ne-He laser. The constructive and destructive interference of the specular coherent radiation beams reflected by the interfaces give a continuous measure of the thickness, rate of growth, and thermal radiation properties of the cryodeposit. From these and other standard measurements the cryopumping speed cryodeposit density and cryodeposit thermal radiation properties are determined as a function of the type gas being deposited, the cryodeposition pressure, the cryodeposit thickness, and the temperature of the gas and cryosurface. The design of the experimental apparatus employing this technique and used for the experimental investigation is discussed as well as the experimental procedures used to obtain the data and the data reduction procedures. Experimental results for physically adsorbed CO2 and H2O cryodeposits on a polished type 304 stainless steel cryosurface are presented. Dissert. Abstr.

N70-18219# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
PULSED N2O MOLECULAR LASER STUDIES
G. J. Mullaney, H. G. Ahlstrom, and W. H. Christiansen Oct. 1969 22 p refs
(D1-82-0925) Avail: CFSTI

The afterglow pulse-gain technique was used to measure the relaxation of the upper laser level in N2O from 300 to 700 K. The rate constant varies with temperature. Measurements of the relaxation time at 300 K agree with the flourescence technique results. Gain studies were also made with gas mixtures in a non-flow system. Singly pulsed N2O + CO + He mixtures at 300 K showed considerable peak gain. However subsequent pulses of these mixtures show that the gain is reduced because of the chemical reaction forming CO2. Measurements of this transformation from one molecular laser mixture to another are discussed. Author

N70-18232 Maryland Univ., College Park.
OPTICAL PUMPING IN CESIUM VAPOR CELL USING A GaAs LASER
Sadegh Siahatgar (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-7207

The preliminary study of 8521A line of cesium leading to the possibility of locking a GaAs laser to this line is carried out. The tuning of GaAs lasers to the cesium line is accomplished. The GaAs laser is frequency modulated so that one mode sweeps across the 8521A line of cesium, hence the GaAs laser operates as an optical sweep generator whose sweep rate can be adjusted. The sweep generator features compared with a more conventional source, permits the use of oscilloscope display of the line shape. Optical detection of absorption and fluorescence was achieved, and a decay experiment of resonant trapping is reported. The experimental method, and results are given together with the calculation, and construction of the cesium vapor cells used in this work. Dissert. Abstr.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-16913 National Lending Library for Science and Technology, Boston Spa (England).
CASTING OF TWO-LAYER CHILLED METAL WORKING ROLLS IN DUCTILE IRON AT THE LUTUGINO ROLL WORKS, USSR
J. Zakrzewski 21 Jul. 1969 18 p refs Transl. into ENGLISH from Przeglad Odlewnictwa (Warsaw), v. 17, no. 12, 1967 p 377–383 In POLISH and ENGLISH
(NLL-Trans-746-127-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The production of chilled rolls in the U.S.S.R. is discussed from the viewpoint of their uses and the requirements placed on them. The compositions of the cast irons used in metal working and other rolls are given. Some characteristics of the rolls are given, including the requirements for hardness and chill depth. A detailed description is given of the production technology of two layer rolls in S.G. iron. Author

N70-16924 National Lending Library for Science and Technology, Boston Spa (England).
PROBABILITY OF STACKING-FAULT FORMATION IN Fe-Mn ALLOYS
L. D. Chumakova et al 21 Jul. 1969 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 6, Nov.–Dec. 1968 p 168–170 In RUSSIAN and ENGLISH
(NLL-Trans-748-204-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Investigated were the effects of nickel, manganese, molybdenum, tungsten, and chromium alloying on the probability of stacking fault formation and diffusion of the austenite lines in an Fe-Mn alloy during filing. Stacking fault formation was determined from the (111), (200), and (311) lines of austenite in iron radiation and comparison with reference standards. Interference curves were drawn through plot points. It was shown that with increasing extent of alloying elements the probability of stacking fault formation and diffusion of the (111) line of austenite for the Fe alloy with 19 to 30 percent manganese decreased. A definite relation existed between the amount of epsilon phase, initial strengthening coefficient, probability of stacking fault formation, and changes in the fine structure of the austenite of Fe-Mn alloys. G.G.

N70-16940# Syracuse Univ., N.Y. Metallurgical Research Labs.
SHEAR CRACK PROPAGATION IN HY-80, HY-130, AND 18 Ni (180) MARAGING STEELS UNDER CYCLIC BI-AXIAL LOADING
H. W. Liu and Dhirendra Narain Lal Sep. 1969 62 p refs
(Contract Nonr-669(21))
(AD-696674; MET-E-1415-969) Avail: CFSTI CSCL 11/6

The lateral shear crack propagation under cyclic bi-axial loading in HY-80, Hy-130 and 18 Ni (180) maraging steels was investigated. At a given ratio of applied shear stress and the shear yield strength of the material, HY-80 steel has the highest resistance to shear crack propagation. At a given stress range, HY-130 steel has a slightly higher resistance to shear crack

propagation. Shear deformation ahead of crack tip and along the crack line and crack sliding displacement, CSD, were measured using moire method. The shear deformation is a power function of the distance from the crack tip. The shear crack propagation rate is proportional linearly to the shear deformation at a small distance from the crack tip and proportional to the second power of crack sliding displacement. Author (TAB)

N70-17014# Illinois Univ., Chicago. Dept. of Materials Engineering.

THE INFLUENCE OF POROSITY ON THE DUCTILITY OF SINTERED BRASS, JAN. – AUG. 1969

W. Rostoker and S. Y. K. Liu Aug. 1968 33 p refs
(Contract DAAA25-68-C-0362)
(AD-696792) Avail: CFSTI CSCL 11/6

Although powder metallurgy products are in increasingly common usage, their mechanical properties are sparingly quoted. In particular, their ductilities are recognized as substantially less than equivalent metals and alloys of full density. The present research program has undertaken to identify the important factors characterizing void population which influence ductility and to place these in the context of recent work on ductile fracture. Author (TAB)

N70-17015# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.

STRUCTURE AND PROPERTIES OF IRON BASE ALLOYS Final Report, Jun. 1957 – Sep. 1969

Harold W. Paxton 1 Nov. 1969 19 p refs
(Contract Nonr-760(14))
(AD-696669) Avail: CFSTI CSCL 11/6

The report summarizes work on relations between structure and properties of various high alloy steels over a period of some 12 years. The experiments frequently involved single crystals permitting examination of crystallographic detail not common in studies of this class of alloys. Author (TAB)

N70-17075# Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.

AN ATOMIC MODEL FOR CLEAVAGE CRACK PROPAGATION IN ALPHA IRON

P. C. Gehlen and M. F. Kanninen Sep. 1969 24 p refs Presented at Battelle Colloq. on the Inelastic Behavior of Solids, Columbus, Ohio, 15-19 Sep. 1969 Submitted for publication
(Contract Nonr-5052(00))
(AD-696117; TR-9) Avail: CFSTI CSCL 11/6

A preliminary study of the atomic arrangements at the tip of a cleavage crack in alpha iron (BCC) is described. Equilibrium configurations are calculated under each of a number of different applied tensile loads. From a detailed study of these configurations the critical point at which crack extension commence is estimated. Author (TAB)

N70-17076# Naval Research Lab., Washington, D.C. Metallurgy Div.

FAILURE OF STRUCTURAL ALLOYS BY SLOW CRACK GROWTH

T. W. Crooker and E. A. Lange 14 Oct. 1969 13 p refs
(AD-696936; NRL-6944) Avail: CFSTI CSCL 11/6

Structural alloys are susceptible to failure by slow crack growth caused by fatigue and corrosion-fatigue. Laboratory studies have provided quantitative engineering data on the resistance of various steels and titanium alloys to slow crack growth. The rate of crack growth per cycle of repeated load was shown to be a function of the fracture mechanics crack tip stress-intensity factor. Methods were shown for relating these results to structural parameters, nominal stress, and flaw geometry. The influence of a salt water environment on slow crack growth and interaction with stress-corrosion cracking were explored. Author (TAB)

N70-17097# Advisory Group for Aeronautical Research and Development, Paris (France).

COOPERATIVE PROGRAMME ON MECHANICAL TESTING OF REFRACTORY METALS

D. Coutsouradis Aug. 1968 134 p refs
(AD-696636; AGARD-568) Avail: CFSTI CSCL 11/6

The report deals with: the determination of room temperature tensile properties of Vascojet 90 (15CDV6) steel sheet, for conventional testing techniques; the same, under high temperature testing conditions; the determination of the recrystallization temperature of TZM molybdenum alloy sheet; and the determination of the tensile properties of TZM molybdenum alloy sheet at RT, 1050, 1450 and 1800C. The objective of the program was to generate information on the adequacy of test techniques and specifications and also on the properties of the materials tested. TAB

N70-17121# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE STUDY OF THE URANIUM/OXYGEN/NITROGEN SYSTEM [CONTRIBUTION A L'ETUDE DU SYSTEME URANIUM/OXYGENE/AZOTE]

Jean-Marie Martin (Ph.D. Thesis—Grenoble Univ., 27 Nov. 1968) Sep. 1969 46 p refs In FRENCH; ENGLISH summary
(CEA-R-3801) Avail: CFSTI

The work reported was mainly concerned with phase relationships between uranium dioxide and nitroxides under a nitrogen pressure of one atmosphere. New types of nitroxides were produced: (1) a UO2 type and (2) a UN type with the formula UNO where $0 < \times 0.15$. The range of existence of these nitroxides was specified, and a monotectoid reaction between UO2 and U2N3 was disclosed. The pseudo-binary character of the section UO2-U2N3 is pointed out, as well as the existence of an eutectic reaction between UO2 and UN (melting temperature circa 2500 C). The limiting compositions of the UO2 and UN phases simultaneously in equilibrium with liquid uranium were also determined. Author (ESRO)

N70-17140# Pennsylvania Univ., Philadelphia. School of Chemical Engineering.

ELECTROCHEMICAL ASPECTS OF HYDROGEN PERMEATION IN IRON AT HIGH HYDROSTATIC PRESSURE Technical Report

John J. DeLuccia (Naval Air Development Center), Koji Yamakawa (Kyoto Univ., Japan), and Leonard Nanis Oct. 1969 19 p refs Submitted for publication
(Contract N00014-67-A-0216)
(AD-696992; UPH2-TR-001) Avail: CFSTI CSCL 11/6

A high pressure system containing an electrochemical method for continuous hydrogen permeation determination through metal foil is described for use at hydrostatic pressures up to 20,000 psi. The diffusion coefficient of hydrogen in Armco iron at 21C is 0.000043 sq cm/sec, unaffected by pressure up to 6200 psi; the solubility of hydrogen in Armco iron is a linear function of pressure up to a value of 7.8 x 10 to the minus 7th power mol H2/cc Fe at 6200 psi, 21C, and does not follow Sieverts law behavior. By linking the hydrogen permeation current caused by cathodic charging with that caused by applied pressure, an overpotential-pressure relationship is obtained. Author (TAB)

N70-17142# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ALUMINUM POWDER PRODUCTION CHARACTERISTICS FOR SINTERED ALUMINUM POWDER

M. G. Stepanova et al 14 Apr. 1969 11 p refs Transl. into ENGLISH from Nauchnyi Sov. Kompleksn. Probl. Kibernetika Vopr. Bioniki, (Moscow), 1967 p 192 – 198
(AD-696167; FTD-HT-23-1337-68) Avail: CFSTI CSCL 11/6

APS aluminum powder used in sintered aluminum powder (SAP) is produced through grinding in a ball mill in the presence

of stearin. A specific particle size corresponds to each grade of APS powder prior to nodulizing. A study of the particle structure for nodulized APS powder showed that such particles consist of smaller particles whose size has no effect on the structure and properties of semifinished SAP material products. No positive results were achieved through introduction of additives to the grinding process. Grinding in gasoline medium served to decrease the powder gas content. TAB

N70-17205# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING RESIDUAL STRESS IN WELDED METAL SAMPLES
R. M. Aronov and V. S. Zoteev 17 Mar. 1969 13 p refs Transl. into ENGLISH from Tsentr. Nauchn. Issled. Inst. Chernoi Met. SB. Trudov, (USSR), no. 48, 1967 p 165–170
(AD-696700; FTD-HT-23-1146-68) Avail: CFSTI CSCL 11/6

Four different types of dismountable tensometers are compared: the Berry tensometer, the Moscow Higher Technical School im. Bauman tensometer, Tensotest, and the Burnshteyn laminar tensometer. It is established that the drilling of apertures and press fitting of fastening studs in these tensometers distort the stress diagram of the investigated specimens; the presence of hinged joints and transmitting elements also is a source of errors. Hence it would be more effective to employ the fundamentally different technique of optical estimation of residual stresses according to the variation in the distance between extremely tiny markings gouged on the surface of the specimen by means of a prick punch proposed by R. M. Aronov. TAB

N70-17222# National Engineering Lab., Glasgow (Scotland). Materials Group.
THE COLD EXTRUSION OF SOME AUSTENITIC CAST IRONS
E. Whitfield Feb. 1968 23 p refs
(NEL-343) Avail: CFSTI

A limited number of billets of nodular chrome-free austenitic cast iron; nodular 0.93%Cr austenitic cast iron and flake 1%Cr austenitic cast iron were cold extruded into rods through small included angle conical-entry dies at extrusion ratios up to 4. Some microcracks were detected in the extruded specimens of the nodular chrome-free austenitic cast iron and of the flake 1%Cr austenitic cast iron. Tensile strengths of up to 80 tons/sq in were obtained from specimens machined from the extruded rods. Author

N70-17245# National Engineering Lab., Glasgow (Scotland). Materials Group.
CREEP OF A CARBON MANGANESE STEEL UNDER CYCLIC STRESS AND TEMPERATURE
M. F. Day and W. M. Cummings Feb. 1968 33 p refs
(NEL-342) Avail: CFSTI

Nearly all creep data are obtained under closely controlled constant conditions of load and temperature. Most high temperature plants, however, are subject to cyclic variations of both, due to periodic off load or reduced load conditions. Test data for a C-Mn steel are presented for various cycles of stress and/or temperature. The effects of cycling of stress or temperature, and of inphase changes of both, are predictable within reasonable limits. It is shown, however, that with out-of-phase changes in stress and temperature, i.e. high stress/low temperature to low stress/high temperature conditions, a very rapid acceleration of strain can occur. Author

N70-17263# Drexel Inst. of Tech., Philadelphia, Pa. Dept. of Metallurgical Engineering.
SOLUTION KINETICS OF CuAl IN AN Al-4 Cu ALLOY
David L. Baty, Richard A. Tanzilli, and Richard W. Heckel Oct. 1969 29 p refs
(Contract N00014-67-A-0406-002)
(AD-696953; TR-2) Avail: CFSTI CSCL 11/6

The results of a recently-developed, spherical, finite geometry, mathematical model using numerical methods are compared to existing closed-form models. The geometry and boundary conditions imposed by the closed-form models are shown to be restrictive in the application of these models to the solution kinetics of second phases. A quantitative metallography study of the solution kinetics of CuAl2 in an Al-4w/o Cu alloy was undertaken to provide data on the changes in second-phase particle size distributions as a function of solution treatment time. The size distributions were shown to vary according to the proposed spherical, finite model formulated using numerical methods. Author (TAB)

N70-17267# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF COUNTERBODY MATERIAL ON FRICTION BETWEEN METAL-GRAPHITE PAIR
L. P. Grigopenko et al 3 Apr. 1969 16 p refs Transl. into ENGLISH from Mashionoved. (USSR), no. 1, 1968 p 71–75
(AD-696611; FTD-MT-24-432-68) Avail. CFSTI CSCL 11/8

The nature of the graphite powder obtained as a result of friction at the AG-1500 graphite-metal interface was studied for four metals: 1Kh18N9 steel, M-3 copper, LS-59-1 brass, and electrolytically deposited chromium. The coefficients of friction for the different metal surfaces were determined experimentally in air and vacuum, and at a relative rate of motion. The nature of the graphite powder was studied by x-ray and electron microscopy technique. Micrographs of the graphite layer formed on the metal surfaces are presented. The size of graphite crystallites formed on the metal surface was estimated after the method of B. E. Warren. It was found that the nature of the counter-body material of the metal-graphite pair affects the structure of the graphite layer on the surface of the metal and the wear mechanism of the graphite surface. However, for applied pressures in excess of the critical pressure (so-called conditions of extreme wear), the mechanism of graphite wear is independent of the nature of the metallic surface. Author (TAB)

N70-17320*# International Harvester Co., Chicago, Ill. Solar Div.
STRUCTURAL AND MECHANICAL EFFECTS OF INTERSTITIAL SINKS
M. J. Klein, M. L. Reid, C. Antonick, A. G. Metcalfe Jan. 1970 36 p refs
(Contract NAS7-469)
(NASA-CR-107852; RDR-1534-14) Avail: CFSTI CSCL 11F

The apparent activation energy for creep and the creep stress required to maintain a constant strain rate were measured for columbium and Cb–1Zr over a range of temperature. Activation energy peaks for Cb–1Zr detected above 2800 F were accompanied by small variations in creep stress. A strain aging peak was found in columbium near 2000 F, and at this peak the creep stress for columbium exceeds that for Cb–1Zr. An activation energy peak was also detected for columbium in this temperature region. Author

N70-17329# Institute of Technology, Helsinki (Finland). Lab. of Physical Metallurgy.
UNIDIRECTIONAL SOLIDIFICATION IN SOME ALUMINIUM ALLOYS
Jarl Forsten (Ph.D. Thesis) Mar. 1969 95 p refs
Avail: CFSTI

The formation of typical segregation and dislocation structures during the undirectional solidification of aluminum and some aluminum alloys is explained with experimental data. A radiographic method was used to observe the solid-liquid interfaces. Temperature gradients in the solidifying alloy were measured by inserted thermocouples to determine the solidification conditions. Author

N70-17332 National Lending Library for Science and Technology, Boston Spa (England).

INFLUENCE OF ELASTIC STRESSES ON THE DECOMPOSITION OF SUPERSATURATED SOLID SOLUTION IN Fe-Ni-Al ALLOYS

A. S. Ermolenko et al 21 Jul. 1969 14 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. USSR (Moscow), v. 27, no. 2, Feb. 1969 p 250–256 In RUSSIAN and ENGLISH

(NLL-Trans-746-205-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

It is shown that external elastic stresses acting during the decomposition of the supersaturated solid solution of alloys of the system Fe-Ni-Al affect the orientation of precipitates exhibiting shape anisotropy. Compressing a crystal in the (100) direction makes orientation of precipitates with their long axes along this direction unfavorable. With compressive stresses directed along the (110) axis, rod-shaped precipitates are predominantly oriented along the perpendicular (100) direction. Author

N70-17354# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE STUDY OF THE FISSION-GAS RELEASE IN METALLIC NUCLEAR FUELS [CONTRIBUTION A L'ETUDE DU DEGAGEMENT DES GAZ DE FISSION DANS LES COMBUSTIBLES NUCLEAIRES METALLIQUES]

Bernard Kryger (Ph.D. Thesis-Conservatoire Natl. des Arts et Metiers) Oct. 1969 90 p refs In FRENCH; ENGLISH summary

(CEA-R-3888) Avail: CFSTI

In order to study the effect of an external pressure for limiting the swelling due to fission-gas precipitation, irradiations were carried out at burn-ups of about 35 000 MWd/ton and at average sample temperatures of 575 C on non-alloyed uranium and uranium-8 percent molybdenum in a thick stainless steel can. A cylindrical central hole permitted fuel swelling from 20 to 33 percent according to the experiment. After irradiation, the uranium samples showed two types of can rupture, one due to the fuel swelling, and the other due to the pressure of the fission gases released through a network of microcracks. The cans of the uranium-molybdenum samples were all undamaged, and it is shown that the gas release occurs by interconnection of the bubbles for swelling values higher than those obtained in the case of uranium. For each type of fuel, a swelling-fission gas release relationship was established. The results suggest that good performances with a metallic fuel intended for use under fast reactor conditions can be obtained. Author (ESRO)

N70-17366*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH-STRENGTH TANTALUM COMPOSITE BY THERMOMECHANICAL WORKING Technical Note

Ruluff D. Mc Intyre Washington Jan. 1970 refs

(NASA-TN-D-5640; E-5201) Avail: CFSTI CSCL 11F

The effect of thermomechanical processing by rolling on the tensile strength and microstructural properties of a tantalum composite was studied. A core made of tantalum sheet and fibers embedded in a matrix of tantalum powder was rolled to very high levels of reduction that resulted in greatly improved strength at 77 F (298 K). The 30-vol. % core composite had a strength of 322 000 psi, and the core had an apparent strength (extrapolated data) of 650 000 psi. The high strength appeared to be associated with a fine stable substructure generated by the thermomechanical working. Author

N70-17428# Lund Univ. (Sweden).

LOCAL MAGNETIC MOMENTS IN DILUTE ALLOYS

Bengt Kjollerstroem 1969 16 p refs

(NP-18017) Avail: CFSTI

Dilute alloys where atoms of transition metals are substitutionally introduced in a nonmagnetic host such as one of the noble metals is investigated. The problem is analyzed formally, and it is shown that a local magnetic moment cannot be formed at zero temperature. The physical properties of the alloys are discussed. NSA

N70-17436# Institute of Technology, Helsinki (Finland). Lab. of Physical Metallurgy.

THE MASSIVE TRANSFORMATION IN SOME IRON-BASED ALLOYS

Erkki O. Raesaenen (Ph.D. Thesis) 1969 87 p refs

Avail: CFSTI

The massive transformation of austenite was investigated in the iron-rich interstitial system, iron-carbon, and the substitutional system, iron-copper. Emphasis was directed towards determining the transformation temperatures and examining the microstructure as a function of composition and cooling rate in relation to the thermodynamics of the transformation. A secondary objective was to establish a correlation between the surface relief markings formed during the transformation of austenite and the real microstructure. Specimens were austenitized at different temperatures and were cooled continuously at different quenching rates. The transformation temperatures were recorded from the cooling or dilatometric waves and the specimens were studied by an electron microscope. Metallographic analyses were made to determine the grain size, volume-fraction of phases, and the distances migrated by the grain boundaries. The results indicate that the massive transformation in Fe-Cu and Fe-C alloy can occur by two different mechanisms and that the associated microstructures differ considerably. D.L.G.

N70-17457# Royal Aircraft Establishment, Farnborough (England).

PREDICTING THE BEHAVIOUR OF MATERIAL SYSTEMS BY FITTING A THEORETICAL MODEL TO OBSERVATION

P. H. H. Bishop and K. F. Rogers Mar. 1969 28 p refs

(RAE-TR-69053) Copyright. Avail: CFSTI

In predicting the behavior of material systems, agreement between prediction and observation is frequently unsatisfactory even when an accurate theory is available, because values for some of the material constants are incorrectly assumed or not known. In these circumstances better predictions can be made by allowing the constants to take best-fit values between plausible limits. The method is discussed and experimental work described to confirm the accuracy of this type of prediction. Author (ESRO)

N70-17489*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy.

RECRYSTALLIZATION CHARACTERISTICS OF TD-NICKEL Annual Status Report

J. J. Petrovic, L. Leonard, and L. J. Ebert Feb. 1969 51 p refs

(Grant NGR-36-003-094)

(NASA-CR-107870) Avail: CFSTI CSCL 11F

Determination is made of the characteristics and mechanism of recrystallization in TD-nickel, a model dispersion hardened system. Recrystallization behavior after rolling and swaging deformations was examined in two forms of TD-nickel, as-extruded and commercial one inch bar. Recrystallization in TD-nickel is observed to be highly dependent upon character of prior deformation, with some deformation types producing recrystallization resistance. There is an outstanding substructural difference between recrystallization-resistant and recrystallization-prone deformations. All ambient temperature deformations examined in the present study produced voids at a significant fraction of thoria particles. Voids appeared to "heal" after annealing at elevated temperatures. The degree of void formation was similar after both recrystallization-resistant and recrystallization-prone deformations, indicating that this phenomena does not control recrystallization in TD-nickel. Author

N70-17473# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
POINT DEFECTS IN NICKEL [LES DEFAUTS PONCTUELS DANS LE NICKEL]
Pierre Peretto (Ph.D. Thesis—Grenoble Univ., 26 Apr. 1967) Sep. 1969 148 p refs In FRENCH; ENGLISH summary
(CEA-R-3772) Avail: CFSTI

The defects in electron irradiated nickel (20 K) or neutron irradiated nickel (28 K) were studied by simultaneous analysis using the magnetic after-effect, electron microscopy and electrical resistivity recovery. Zone refined nickel was alloyed with a small amount of iron. The temperature dependent electrical recovery may be divided in four stages. The substages 1 of stage 1 are due to the disappearance of single interstitials into vacancies. The interstitial defect has a split configuration with a migration energy of about 0.15 eV. Stage II is due to more complicated interstitial defects: di-interstitials and larger and larger interstitial loops for the substages. The loops may be seen by electron microscopy and impurities can play the role of nucleation centers for the loops. Stage III (370 K) is due to two types of di-vacancies. During stage IV(410 K) the single vacancies migrate. Vacancy type loops and interstitial type loops grow concurrently and disappear at about 800 K as observed by electron microscopy. Author (ESRO)

N70-17519# Oxford Univ. (England). Engineering Lab.
THE EFFECT OF STRAIN RATE AND TEMPERATURE ON THE YIELD AND FLOW OF POLYCRYSTALLINE NIOBIUM AND MOLYBDENUM, PART 1 Final Progress Report
J. D. Campbell and T. L. Briggs 1969 57 p refs
(Contract 70/GEN/9469)
(Rept-1091/69-Pt-1) Avail: CFSTI

Experimental results of polycrystalline niobium and molybdenum specimens deformed in compression over a wide range of strain rates and temperatures are presented. Results are not consistent with current deformation theories, and the assumption that flow is controlled by a single thermally activated mechanism is discussed. Author (ESRO)

N70-17565*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
EVALUATION OF TANTALUM/316 STAINLESS STEEL BIMETALLIC TUBING Final Technical Report, 23 Mar. 1967 - 24 Jun. 1968
J. N. Kass and D. R. Stoner 24 Jun. 1968 75 p refs
(Contract NAS3-10601)
(NASA-CR-107871; WANL-PR-PPP-001) Avail: CFSTI CSCL 11F

The purpose of this investigation was to evaluate tantalum/316 SS bimetal tubing made by different manufacturing techniques. Two lots of tubing were fabricated by extrusion to size and were produced by the Nuclear Metal Division of Whittaker Corp. (Lot A) and by Metallonics Corp. (Lot B) using different extrusion techniques. A third lot of tubing, (Lot C) was produced by Aerojet General Corp. by explosive bonding to size. The overall quality of the Ta/316 bimetal tubing made by coextrusion to final size was superior to that of the explosively bonded to size tubing. The nature of the explosive bonding process resulted in inherent unbonded areas in the as fabricated tubing which propagated during subsequent thermal cycling. Also the explosive bonded to size tubing contained a nearly continuous layer of varying thickness of a brittle intermetallic compound at the bimetal interface. The coextruded to size tubing exhibited a sound bimetal bond and no intermetallic layer was observed at the Ta/316 interface by optical metallography. Of the three lots of tubing, the Lot A made by extruding over a mandrel was superior in all respects. The Lot B tubing, made by the filled billet technique, was similar to the Lot A except for surface defects and straightness. Author

N70-17578# Akademiya Nauk URSR, Kiev.
INVESTIGATING THE ELECTRONIC PROPERTIES OF METALS AND ALLOYS
D. I. Popovich, ed. 1967 138 p refs In RUSSIAN
Avail: CFSTI

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10. X-RAY ABSORPTION OF IRON-GROUP METALS IN THEIR BORIDES S. M. Karalnik, E. T. Kachkovskaya, and A. B. Lyashchenko (Kiev Univ., USSR) p 92–96 refs (See N70-17586 06-06)

11. X-RAY EMISSION SPECTRUM OF COBALT IN SILICIDES V. P. Tsvetkov, N. D. Savchenko, and A. V. Kalenichenko p 97–102 refs (See N70-17587 06-06)

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13. THE NATURE OF THE INTRAATOMIC REACTION AND ELECTROSTATIC POTENTIAL IN THE KCl LATTICE K. I. Gorokhov, V. P. Tsvetkov, and L. V. Shevtsov p 107–116 refs (See N70-17589 06-26)

14. X-RAY STUDY OF MANGANESE AND MAGNESIUM FERRITES IN THE TEMPERATURE RANGE OF MAGNETIC TRANSFORMATION P. P. Krichok p 117–123 refs (See N70-17590 06-17)

15. THE TEMPERATURE DEPENDENCE OF THE ELECTRICAL RESISTANCE OF MOLYBDENUM V. I. Makarov and T. A. Sverbilova p 124–129 refs (See N70-17591 06-17)

16. INVESTIGATING THE ELECTRICAL CONDUCTIVITY OF FILMS OF CHROMIUM SILICON IN THE CRYSTALLIZATION PROCESS A. I. Sokolenko and I. B. Staryy (Odessa Polytechnic Inst.) p 130–134 refs (See N70-17592 06-26)

N70-17577# Akademiya Nauk URSR, Kiev.
X-RAY STUDIES OF THE ELECTRON STRUCTURE OF

D-METALS

V. V. Nemoshkalenko *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 5–26 refs In RUSSIAN (See N70-17576 06-17)

Avail: CFSTI

A literature survey is presented on the study of metals and alloys with incomplete 3d- and 4d-shells. These studies serve not only as a means for constructing theories of the condensed state, but also for constructing approximate models of the electron structure of these metals. These structures should prove useful in composing new alloys. The need is emphasized for greater uniformity in obtaining data, by using the latest equipment with high resolution factors. Transl. by H.W.

N70-17578# Akademiya Nauk URSR, Kiev.

A STUDY OF THE ELECTRON PROPERTIES OF REFRACTORY METALS AND THEIR ALLOYS

I. Ya. Dekhtyar, V. A. Yevtikhin, D. A. Levina, and V. S. Mikhalenkov *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 27–39 refs In RUSSIAN (See N70-17576 06-17)

Avail: CFSTI

The electron-positron annihilation method was used for the study of the electron structure of refractory systems, such as tungsten-molybdenum, tungsten-rhenium, and niobium-tantalum in a wide range of concentrations. It is shown that the reflecting ability of the alloys is sensitive to their surface composition and that the electron structure of the alloy surface changes in relation to its composition, particularly during alloying using only few additives. Transl. by H.W.

N70-17579# Akademiya Nauk URSR, Kiev.

STUDYING THE PARAMAGNETIC SUSCEPTIBILITY OF ALLOYS BASED ON TUNGSTEN, MOLYBDENUM, TANTALUM, RHENIUM, AND NIOBIUM

I. Ya. Dekhtyar, V. A. Yevtikhin, D. A. Levina, V. S. Mikhalenkov, and V. I. Silantyev *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 40–50 refs In RUSSIAN (See N70-17576 06-17)

Avail: CFSTI

The paramagnetic susceptibility of the alloys under study was measured on a specially manufactured magnetic scale. Sharply defined anomalies were discovered in the concentration relationships of the paramagnetic susceptibility of the systems. The relationship of the paramagnetic susceptibility to the electron concentration outside the closed 3p-shell was not established, since the number of s plus d electrons in these systems does not depend on the composition. Electron concentration is not the basic factor which determines the behavior of the paramagnetism of solid solutions. The gyromagnetic relationship for non-ferromagnetic metals together with the spin paramagnetism are determined by the orbital paramagnetism. Transl. by H.W.

N70-17580# Kiev Univ. (USSR).

THE MAGNETIC SUSCEPTIBILITY OF ALLOYS IN THE MAGNESIUM-CADMIUM SYSTEM

P. P. Kuzmenko, G. I. Kalnaya, and P. A. Suprunenko *In* Akad. Nauk. Investigating the Electron. Properties of Metals and Alloys 1967 p 51–59 refs In RUSSIAN (See N70-17576 06-17)

Avail: CFSTI

The atomic ordering effect on the magnetic properties of magnesium-cadmium alloys is studied, especially on the temperature and concentration change of the magnetic susceptibility. The temperature dependence of magnetic susceptibility was investigated by measuring the force acting on the specimen in a heterogeneous magnetic field. Results show that alloys rich in magnesium are paramagnetic and have a complex temperature relationship of magnetic susceptibility. Transl. by H.W.

N70-17581# Akademiya Nauk URSR, Kiev.

ANTI-FERROMAGNETISM AND THE DISSOCIATION OF SOLID SOLUTIONS IN THE SYSTEMS CHROMIUM-RUTHENIUM AND CHROMIUM-OSMIUM

A. K. Butylenko and N. A. Kozlova *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 60–62 refs In RUSSIAN (See N70-17576 06-17)

Avail: CFSTI

The immobility of the dependence curves of the Neel point to the concentration after various thermal processes is proposed as a criterion of the stability of the structure of a solid solution. The Neel temperature for the given alloy is determined from temperature dependence curves for the electrical resistance. The relationship of the position of the Neel point of solid solutions in proportion to the increase of the ruthenium and osmium concentration is presented. In comparison to homogenized annealing, a prolonged annealing at 500 C leads to mixing the curves of the dependence of the Neel point on the concentration in the range of lower concentrations of ruthenium and osmium in the solution. The solid solutions dissociate with the formation of enriched and lean sectors of the solution, since only one bend is observed in the electrical resistance curves. These data agree with system phase equilibrium diagrams and with the general principles of lamination of solid solutions. Transl. by H.W.

N70-17582# Kiev Univ. (USSR).

PROPERTIES OF THE ANTIFERROMAGNETIC COMPOUND CrSb

P. P. Kuzmenko, P. A. Suprunenko, and G. A. Galina *In* Akad. Nauk Investigating the Electron. Properties of Metals and Alloys 1967 p 63–67 refs In RUSSIAN (See N70-17576 06-17)

Avail: CFSTI

The specific electrical resistance of the compound CrSb was investigated in the range from room temperature to 920 C. It is shown that the specific electrical resistance reaches a maximum value in the range T equals 420 + or - 5 C. Thus, there is no basis for asserting that at higher Neel temperatures the alloy changes from the metallic to the semiconductor state. Results of experiments on electrical resistance, heat capacity, and magnetic susceptibility reveal that the Neel temperature for the compound CrSb must be 420 C. Transl. by H.W.

N70-17584# Zaporozhe State Pedagogical Inst. (URSR).

MAGNETIC FIELD EFFECT ON THE TEMPERATURE OF PHASE TRANSITIONS IN BISMUTH

F. D. Miroshnichenko and V. L. Snezhnoy *In* Akad. Nauk Investigating the Electron. Properties of Metals and Alloys 1967 p 72–77 refs In RUSSIAN (See N70-17576 06-17)

Avail: CFSTI

It is shown experimentally that the hardening of bismuth specimens began at different points depending on the size of the magnetic field. An increase in the magnetic field causes the dimagnetic properties to decrease and bismuth to become more paramagnetic. It is found that a formula used for calculating the magnetic effect on temperature change in bismuth requires more accuracy and generalization. This is necessary because of the incomplete calculation of the interaction of the magnetic field and the substance. Transl. by H.W.

N70-17585# Akademiya Nauk URSR, Kiev.

THE K-SERIES EMISSION LINES OF THE X-RAY SPECTRUM OF CHROMIUM AND CHROMIUM OXIDE

V. V. Nemoshkalenko and M. A. Mindlina *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 78-91 refs *In* RUSSIAN (See N70-17576 06-17)

Avail: CFSTI

A high resolution spectograph, which yields details of the fine structure of the X-ray emission bands of transition metals of the first large period, was used to repeat an earlier study of chromium and its oxide. Results show that the short-wave band of X-ray emission spectrum independently of the K, L, and M series reflects the general density of the states in the valence-hybridized

dsp-band of the transition metal. The electron structure of atoms of transition metals in a solid also completely differ from that which occurs in an isolated atom. The predominance of the states of p-symmetry in the external energy band is natural to the electron structure of chromium. It is shown that the electron structure of the atom in a metal actually differs from the structure in an isolated atom. This also takes place in oxides.
Transl. by H.W.

N70-17590# Akademiya Nauk URSR, Kiev.
X-RAY STUDY OF MANGANESE AND MAGNESIUM FERRITES IN THE TEMPERATURE RANGE OF MAGNETIC TRANSFORMATION
P. P. Krichok. *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 117–123 refs In RUSSIAN (See N70-17576 06-17)
Avail: CFSTI

X-ray structural and spectral studies of manganese and magnesium ferrites were conducted while varying their temperatures. The constant of the crystal lattice was determined, along with the characteristics of the motion of the thermal expansion factor in relation to temperature. Properties of K-absorption of X-rays by the metals of the ferrites were also investigated. It is shown that in the region of the magnetic transformation temperature functional processes may be observed when changing the parameter of the lattice. The monotonous change of the lattice constant is broken. This change is more noticeable in the manganese ferrite than in the magnesium. The annealing of ferrite specimens from a definite temperature preserves the state and position of the ferrite ions for a given temperature.
Transl. by H.W.

N70-17591# Akademiya Nauk URSR, Kiev.
THE TEMPERATURE DEPENDENCE OF THE ELECTRICAL RESISTANCE OF MOLYBDENUM
V. I. Makarov and T. A. Sverbilova. *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 124–129 refs In RUSSIAN (See N70-17576 06-17)
Avail: CFSTI

The temperature dependence of the electrical resistance of molybdenum was studied in order to explain the scattering mechanism of conductivity electrons in the metal. Temperature dependence was found for the interval 0.9 to 300 K. The electron-electron and electron-phonon collisions were described. The length of the free flow of electrons was investigated by studying the specific resistance of fine cylindrical specimens in relation to their diameter. The presence of the radial gradient of the admixtures in the specimen mass was a major factor in determining the precise measurement of the electron path.
Transl. by H.W.

N70-17676*# Gulton Industries, Inc., Metuchen, N.J. Battery and Power Sources Div.
PRODUCTION OF UNIFORM NICKEL-CADMIUM BATTERY PLATE MATERIALS Quarterly Report, 13 Jun. – 12 Sep. 1969
12 Sep. 1969 21 p
(Contract NAS5-21045)
(NASA-CR-107902; QR-1) Avail: CFSTI CSCL 11F

Sample lots of sintered nickel plaque were prepared in a battery plate production facility. This was done in an experiment to determine the effect of material and process variables on their physical characteristics. The variables studied were: sintering time, sintering temperature, slurry viscosity, sintering atmosphere, priming of substrate, and bulk density of nickel powder. Batch to batch variation in the nickel powder would also be an observable response. Initial evaluation was concentrated on determining trends caused by the aforementioned variables on porosity and resistivity.
Author

N70-17681 National Lending Library for Science and Technology, Boston Spa (England).
DIFFUSION REDISTRIBUTION OF ELEMENTS IN THE TRANSITION ZONES OF CLAD METALS
J. A. Golovanenko 21 Jul. 1969 17 p refs Transl. into ENGLISH from Metalloved. Term. Obrabotka Metal. (Russia), no. 2, 1969 p 35–42 In RUSSIAN and ENGLISH
(NLL-Trans-746-197-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

Studies on diffusion processes in the transition zone of various clad metals are presented. Results indicate: (1) Carbon is the principal element diffusing in the transition layers of carbon-steel composites clad with stainless steel; carbon diffuses towards the cladding chromium or chromium-nickel steel layer, with the formation of a reverse concentration gradient; the diffusion of carbon in clad metal takes place at a temperature as low as 425 C. (2) The diffusion of carbon in Kh18N10T and OKh13 stainless steels leads to the formation in the boundary zones of a network of M23C6 and M7C3 carbides which are in the form of films of 500-2000 A thickness. (3) To limit the diffusion of carbon and iron into the cladding layer, it is desirable to employ an intermediate nickel layer. (4) In metal clad with chromium-nickel stainless steel, the nickel interlayer dissolves during heat-treatment and the adhesion between the layers increases. (5) In St. 3 steel clad with Monel alloy, the main influence on the properties of the transition zone is exerted by the diffusion of iron into the Monel alloy.
Author

N70-17714# British Iron and Steel Research Association, London (England). Metallurgy Div.
THE APPLICATION OF THERMOMECHANICAL TREATMENTS TO ENGINEERING STEELS
D. J. Latham and D. K. Ganguli [1969] 18 p refs *Its* BSIRA Open Report
(MG/A/88/68; TIL-BR-14825) Avail: CFSTI

Considerable variations in mechanical properties may be obtained using thermomechanical treatements, by deformation prior to and during transformation, or warm working following transformation. The impact properties for ferrite pearlite steels may be enhanced by controlling the formation of a subgrain size through recovery processes in the ferrite. Several techniques for obtaining this ideal structurural refinement are reviewed and it is shown that isoforming produces the most stable structure. Various thermomechanical treatments have been applied to a few low alloy steels and in general it has been found that for a given strength level the impact properties following treatment are superior to those obtained by conventional treatments. Marked improvements in mechanical properties result from warm working, the extent of which depend on the working temperature, degree of reduction and prior structure.
Author

N70-17716# British Iron and Steel Research Association, London (England). Metallurgy Div.
IMPROVED ENGINEERING STEELS IN THE YIELD STRENGTH RANGE 62-110 H BAR (40-70 TONF/SQ IN)
[1968] 27 p refs *Its* BISRA Open Report
(MG/A/87/68; TIL-BR-14828) Avail: CFSTI

Families of low carbon manganese steels, containing additions of boron, molybdenum, niobium and vanadium, have been examined with the aim of obtaining mechanical properties suitable for engineering applications in small sections. The target was to achieve yield and tensile strengths in the ranges 62 to 110 h bar (40 to 70 tonf/ sq in and 77 to 125 h bar (50 to 80 tonf/sq in) respectively. The lower end of the strength range could be met by manganese–molybdenum– vanadium steels in the air cooled and tempered condition. Progressively higher strengths within the range could be obtained by 0.2 to 0.25%C steels with secondary hardening additions of vanadium. Strength increments were obtained by quenching from the rolls and by lowering the temperature of rolling before quenching. The application of roll–quenching to commercial quality steels of the En14 and 16 type was demonstrated.
Author

N70-17889# Brookhaven National Lab., Upton, N.Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW. VOLUME 7, NUMBER 3: A BIMONTHLY TECHNICAL PROGRESS REVIEW
Jun. 1969 117 p refs Sponsored by AEC
(BNL-50190-Vol-7-No-3) Avail: CFSTI CSCI 11/06

Information on research and development in the U.S. on high temperature liquid metal technology is reviewed. Information is summarized on physical properties and thermodynamics, fluid dynamics, heat transfer, corrosion and erosion, instrumentation, component development, systems studies, chemistry, fabrication, and safety. Author (NSA)

N70-17963# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FRACTOGRAPHY, HARDENABILITY, AND PROPERTIES OF ALLOYS
M. P. Braun et al 9 Sep. 1969 379 p refs Transl. into ENGLISH from Fraktografiya, Prokalivaemost i Svoistva Splavov (Kiev), 1966 p 1-312
(AD-696357; FTD-MT-24-408-68) Avail: CFSTI CSCL 11/6

Results of investigations of effect of alloying elements on the strength, ductility, susceptibility to brittle failure, hardenability, heat resistance and structure of iron, steel and cast iron are given. A fractographic study of material fracture and methods of temper brittleness investigation is presented and the relationship between material structure, thermomechanical treatment and material properties is described. Author (TAB)

N70-17966# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
DISLOCATION DAMAGE IN TANTALUM AFTER CYCLIC LOADING Scientific Report
Yigal Komen (Cornell Univ.) and David G. Brandon Aug. 1969 28 p refs
(Contract F61052-69-C-0042)
(AD-696154; MED-20; AFOSR-69-2766TR; SR-2) Avail: CFSTI CSCL 11/6

The dislocation distribution in tantalum foil after fatigue testing in the region of the yield point has been determined quantitatively using thin film electron microscopy. Changes in the measured micro-structural parameters as a function of stress level, test temperature and number of loading cycles have been related to a microscopic model of the fatigue process. The model leads to a consistent criterion for fatigue failure based on the gradual growth of impenetrable subboundary groups of immobile dislocations. Author (TAB)

N70-18086*# Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF COMPOSITION ON THE MECHANISM OF STRESS-CORROSION CRACKING OF TITANIUM ALLOYS IN N2O4, AND AQUEOUS AND HOT-SALT ENVIRONMENTS
J. D. Boyd, P. J. Moreland, W. K. Boyd, R. A. Wood, D. N. Williams et al Washington NASA Feb. 1970 85 p refs
(Contract NASr-100(09))
(NASA-CR-1525) Avail: CFSTI CSCL 11F

A series of Ti-7Al-base alloys was evaluated for susceptibility to aqueous and hot-salt stress-corrosion cracking. All of the alloys were found to be susceptible to aqueous stress-corrosion cracking. The hot-salt tests were not conclusive and are being repeated. Oxygen has the same effect as aluminum on the susceptibility to aqueous cracking. To further characterize Ti-4Al- and Ti-8Al-base alloys, selected compositions were heat treated and/or processed to evaluate (1) the solution-heat-treated-plus-aged condition, (2) the acicular transformed beta condition, and (3) the stabilized condition which promotes Ti3Al formation. The solution-heat-treated-and-aged alloys shows an inverse relationship between strength and fracture toughness in air and salt water and have the same stress-corrosion characteristics as the equiaxed alloys. Author

N70-18181# British Iron and Steel Research Association, London (England). Metallurgy Div.
A STUDY OF FERROUS BASED SOFT MAGNETIC MATERIALS FOR TRANSFORMER AND SIMILAR APPLICATIONS
T. F. Foley, D. A. Leak, R. A. Newbury, A. R. Pomeroy, and A. R. Matthews [1968] 23 p refs *Its* BISRA Open Report
(MG/CE/102/68; TIL/BR-14823) Avail: CFSTI

The electromagnetic properties of alternative ferrous-based alloy systems were examined in order to find materials superior to commercial grain-oriented silicon-iron for use in the magnetic cores of power electrical equipment. Four major electromagnetic characteristics which determined the value of an alloy for soft magnetic applications were chosen. These were: (1) electrical resistivity which must be as high as possible (2) magnetic saturation which must be as high as possible, (3) magnetocrystalline anisotropy which should be as low as possible, and (4) magnetostriction which should be as low as possible. The studies indicate that ferrous alloys produced with simultaneously higher resistivity and saturation are not suitable for power transformer applications. Additions of aluminum, manganese, or phosphorus produced alloys similar in magnetic properties to grain-oriented silicon-iron but are not economically feasible to produce. Because manganese gave small improvements in all four electromagnetic parameters, other applications for alloys containing manganese are suggested. M.H.E.

N70-18215# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SATURATED VAPOR PRESSURE IN THE SYSTEM PbTe-SnTe
V. V. Sokolov et al May 1969 6 p refs Transl. into ENGLISH from Izv. AN SSSR, Neorgan. Materialy (Russian), v. 5, no. 2, 1969 p 275-278 Sponsored by MIT, Lincoln Lab.
(Rept-181-69-407-RULL) Avail: CFSTI

The saturated vapor pressure of the tellurides of lead and tin were measured. A qualitative investigation of the composition of the vapor showed that the basic components in the vapor are molecules of PbTe and SnTe. The results of measuring the partial vapor pressure of lead telluride and tin telluride in the system PbTe-SnTe are tabulated. Based on the data obtained the activities, the partial and integral free Gibbs energies of the system were calculated, and the system is considered to deviate only slightly from the ideal behavior. F.O.S.

N70-18239# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FATIGUE AND EMBRITTLEMENT OF METALLIC MATERIALS
V. S. Ivanova et al 23 Sep. 1969 154 p refs Transl. into ENGLISH from the Russian
(AD-696519; FTD-HT-23-258-69(JPRS)) Avail: CFSTI CSCL 11/6

The subjects covered include: methods of determining metal susceptibility to brittle fracture and the pattern of crack propagation under static and cyclic loads, the embrittling effect of cyclic loads, the influence of stress concentrators and fretting-corrosion on fatigue resistance, problems of developing materials with high resistance to crack propagation, and various aspects of elastic materials and their mechanical properties. TAB

N70-18287# Denver Research Inst., Colo. Metallurgy Div.
A STUDY OF THE FACTORS CONTROLLING IMMISCIBILITY IN LIQUID-METAL ALLOYS
Donald T. Klodt [1969] 43 p refs
(DRI-2458) Avail: CFSTI

The possibility of extending the existing theories of binary liquid immiscibility to ternary cases, and the comparison of the calculated properties of ternary systems with experimental results are reported. A review of previous studies; the extension of the

theories of Hildebrand and Scott, Mott, and Shimoji; and an empirical approach to liquid immiscibility with the periodic grouping of binary systems are presented. Data comparison, and the periodic relationships between liquid-immiscible and various simple eutetic systems are tabulated. F.O.S.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-16929 National Lending Library for Science and Technology, Boston Spa (England).

ELECTRODEPOSITION OF CADMIUM-NICKEL ALLOYS FROM A SULPHAMATE ELECTROLYTE

N. T. Kudryavtsev et al 21 Jul. 1969 12 p refs Transl. into ENGLISH from Zashch. Metalloved. (Russia), v. 4, no. 6, Nov.–Dec. 1968 p 707–711 In RUSSIAN and ENGLISH

(NLL-LTI-746-117-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupon

Cathodic polarization measurements, obtained during the separate and simultaneous electrodeposition of cadmium and nickel from sulphamate electrolytes under the action of glycocoll, gelatin, and naphthalenedisulphonic acid are presented. Author

N70-16930 National Lending Library for Science and Technology, Boston Spa (England).

THE INFLUENCE OF THE METHOD OF MELTING UPON THE HOMOGENEITY OF GLASS, AS SHOWN BY LIGHT SCATTERING

A. Winter 1 May 1969 10 p refs Transl. into ENGLISH from Verres et Refractaires (Paris), v. 21, part 6, 1967 p 509–513

(NLL-Trans-2552-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Melting process effects on glass homogeneity were investigated, using Rayleigh's ratio measurements, with structural or chemical inhomogeneities in glass giving rise to intensity changes of light scattering. The measurements were performed on optical glasses, melted under widely varying conditions: in refractory, silica, or platinum crucibles or in a continuous furnace. The influence of the heating process and the container type is discussed. Author

N70-16943# Technion - Israel Inst. of Tech., Haifa. Material Mechanics Lab.

DYNAMIC INELASTIC BEHAVIOR OF MATERIALS Final Scientific Report, 1 Jun. 1966–31 May 1969

Sol R. Bodner Aug. 1969 20 p refs

(Contract AF 61(052)-951)

(AD-696659; MML-18; AFOSR-69-2765TR) Avail: CFSTI CSCL 11/4

The principal subjects investigated were the repeated discontinuous yielding of metals, viscoelastic and dynamic strength properties of composites, and the formulation of constitutive equations to represent viscoplastic behavior at large deformations. Author (TAB)

N70-16967 Society of Plastics Engineers, Inc., Stamford, Conn. Vinyl Plastics Professional Activities Group.

VINYL PLASTICS: FUNDAMENTALS OF MATERIALS AND COMPOUNDING PRACTICES Lecture Notes

John H. Hyden, ed. Sep. 1969 87 p refs Presented at the PAG Seminar, Fullerton, Calif., 10–11 Sep. 1969

Copyright. Avail: Issuing Activity

Processing, properties, and performance test data on vinyl plastics are presented, with graphs and tables used to amplify the text. The aspects covered include general purpose polyvinyl chloride (PVC) resins; dispersion and solutions resins, and vinyl latexes; modifying resins for vinyls; plasticizers; degradation and stabilization of PVC; fillers for vinyls; pigmentation of vinyls; compounding and premixing; vinyl foam; and properties and testing of flexible vinyl chloride plastics. Bibliographies on each topic are included. M.G.J.

N70-17085# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

ON THE FREE-VOLUME MODEL OF THE LIQUID-GLASS TRANSITION

David Turnbull and Morrel H. Cohen Sep. 1969 24 p refs

(Contract N00014-67-A-0298-0009)

(AD-696945; TR-24) Avail: CFSTI CSCL 11/2

We have improved the free volume model for molecular transport in dense fluids by taking account of the variable magnitude of the diffusive displacement. The development is carried through in a way which may display more clearly the relation between the free volume model and the Enskog theory. Molecular dynamics computations have shown that the self-diffusion coefficient in the hard sphere fluid at the highest densities is falling precipitously, with increasing density, away from the Enskog values. It appears that this density trend, which was attributed to back scattering, if continued, would lead to a continuous solidification. It is shown that the magnitude and density trend of this deviation are described satisfactorily by the free volume expression, where the free volume is referred to the specific volume of the Bernal glass. We conclude that at least the molecular transport manifestation of a liquid-glass transition can be deduced entirely within the framework of the van der Waals physical model for liquids with due corrections for the variation of the effective hard core radius with temperature. The free volume model results from a crude, but physically plausible, approach to this problem. Author (TAB)

N70-17119# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.

CARBON FIBRES OF HIGH MODULUS

S. Allen, G. A. Cooper, and R. M. Mayer (Atomic Energy Board) Nov. 1969 26 p refs

(NPL-IMS-7) Copyright. Avail: CFSTI

As part of a broad program on composite materials research, an attempt is being made to understand the structure of carbon fibers and to find ways to improve their mechanical properties. Experiments were conducted to determine whether significant improvements can be made by neutron irradiation and boron doping. It is suggested that future developments should be directed towards producing a fiber which is as free as possible from microscopic defects, such as surface flaws and defects derived from foreign particles or bubbles in the spinning dope. Dislocation motion in the finished carbon fibre needs to be avoided whenever possible. ESRO

N70-17167*# United Aircraft Corp., East Hartford, Conn.

OPTICAL ABSORPTION IN FUSED SILICA DURING IRRADIATION AT HIGH-TEMPERATURE

Nov. 1969 64 p refs

(Contract NASw-847)

(NASA-CR-107838; H-930709-1) Avail: CFSTI CSCL 11B

In situ optical experiments were conducted to determine the level of irradiation-induced optical absorption that exists in Corning Grade 7940 fused silica at elevated temperatures during 1.5-Mev electron irradiation and during nuclear reactor irradiation. The optical absorption was measured at the peak of the strong irradiation-induced absorption band in fused silica centered at 2180 A over a range of specimen temperatures from 170 to 900 C. Several additional measurements were made at longer wavelengths (2700 A and 4500 A) to investigate the width of the absorption band and to check the absorption where strong absorption bands

are not expected to exist. The electron irradiation experiments were conducted using a Dynamitron electron accelerator as a source of 1.5-Mev electrons. The induced absorption and specimen temperature were measured before, during, and after the irradiation; transient as well as steady state, data were obtained. The nominal irradiation time for the electron irradiation experiments was 1000 sec. Author

N70-17174# Naval Ship Research Development Center, Annapolis, Md. Materials Lab.

STERIC FACTORS AFFECTING FRICTION AND WEAR OF POLYALKENES Final Report

Paul Legally and Robert Nagy Oct. 1969 37 p refs

(AD-690964; MATLABS-345; NSRDC-3190) Avail: CFSTI CSCL 11/9

The sliding performance of polyalkenes in rubbing contact with a metal (oxide) surface was investigated in relationship to the structural order and molecular symmetry. High-density polyethylene surpassed, in its overall sliding performance, the substituted crystalline polyalkenes. The ability of the conventional (branched) polyethylene to function as a low friction contact when water is the lubricant is attributed to the presence of amorphous regions also present in the linear type. The erratic sliding of isotactic polybutene (and other homologs) is explained by internal friction in the rubbing interface resulting from polymorphic transitions. Cross-linking with a peroxide increases friction of polyethylene, but it reduces the abrasive wear of the composites containing carbon black. The use of highly reactive channel blacks requires no free radical source, and a further reduction in abrasive wear can be achieved by auxiliary cross-linking agents such as ethylene imine which reacts exothermally with the acidic surface of the carbon black present in the composite structure. The ratio of crystalline and amorphous conformations governs the overall sliding performance of polyalkenes. Frictional effects due to different mating surfaces are explained by material transfer and interfacial phase elastic phenomena. Author (TAB)

N70-17213# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.

EXPOSURE OF ELASTOMERS TO HYDRAZINE AND AIR, WATER VAPOR, OR CARBON DIOXIDE Technical Report, Jun. – Aug. 1968

Hideyo H. Takimoto, Genevieve C. Denault, and Peter A. Marsh 1 Jul. 1969 19 p refs Revised

(Contract F04701-69-C-0066)

(AD-697029; TR-0066(5135-01)-1-Rev; SAMSO-TR-69-344) Avail: CFSTI CSCL 11/10

Specimens of Stillman Rubber (SR) 721-P80 and SR 724-90 (forms of ethylene-propylene rubber) potential elastomers for valve seat applications in hydrazine monopropellant systems, were alternately exposed to hydrazine and either air, water vapor, or carbon dioxide. The weight changes of the elastomers were determined during these cyclic exposures, and periodic checks of the thickness changes were made. The weight change for SR 724 leveled off at 2 to 3 percent, while that of SR 721 continued to increase with the number of cycles (for hydrazine and vapor, 26 percent after 40 cycles). SR 724 is superior to SR 721 in terms of its swelling characteristic with hydrazine where periodic exposures to air are encountered. Author (TAB)

N70-17360*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE NONDESTRUCTIVE EVALUATION OF LOW DENSITY FOAM-ALUMINUM COMPOSITE MATERIALS

W. N. Gottfelter, B. F. Bankston and P. C. Duren 10 Oct. 1969 42 p

(NASA-TM-X-53940) Avail: CFSTI CSCL 11D

NOPCO BX-250, a polyurethane spray foam is now used as cryogenic insulation for S-II stages of the Saturn vehicle. This application has required considerable effort in the development of nondestructive methods to evaluate the mechanical integrity of foam to metal bonds. Certain inspection problems associated with low density foam-aluminum composites are evaluated in this report. The development of audio frequency methods required to overcome these difficulties are described. Additional effort was required to adapt one of these audio frequency methods and to develop radiographic techniques for the detection of voids in the foam. The complementary nature of these void detection methods is shown. All of the methods are thoroughly discussed. They are illustrated with numerous drawings, photographs, and radiographs to clearly show their current value to the Saturn program and their potential for other applications. Author

N70-17374# Royal Aircraft Establishment, Farnborough (England).

RAIN EROSION. PART 7: AN ASSESSMENT OF VARIOUS PROTECTIVE COATINGS

R. B. King Jul. 1969 14 p refs

(RAE-TR-69133) Copyright. Avail: CFSTI

This report discusses the rain erosion resistance of various coatings used as protection on radomes, aerial covers and metallic leading edges. Specialised applications such as the erosion problems connected with air cushion vehicles are also included. Most of the tests were conducted under standard conditions of 500 mile/h in 1 in/h simulated rainfall but some results at lower speeds are listed. The best erosion resistance was obtained with stainless steel, but some polyurethane sheet materials also gave excellent protection, provided that a good adhesive bond to the substrate had been obtained. A form of polyurethane self-adhesive tape gave protection to an intermediate degree and had the added advantages of ease of application and replacement when necessary. Author (ESRO)

N70-17418*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

DEVELOPMENT OF POLYMERIC FUEL TANK SEALANTS FOR ADVANCED AEROSPACE VEHICLES

William J. Patterson and Lawrence R. Moffatt, Jr. 23 Dec. 1969 44 p refs

(NASA-TM-X-53970) Avail: CFSTI CSCL 11A

This report describes studies in the development of a polymeric material capable of functioning as a fuel tank sealant in hypersonic aircraft. The preparation of a number of organic intermediates is outlined which encompasses a variety of systems including aryl-fluorinated compounds and aromatic polycyclic structures. Preliminary results indicate that incorporation of fluorine atoms into the basic polymer structure imparts a degree of aviation fuel resistance, a property which the sealant must of necessity possess. The rationale supporting the selected polymeric systems chosen for study and investigation is outlined in detail along with other pertinent factors involved in the selection of candidate materials. Supplemental studies involving the development of thermally resistant polymers as fuel tank sealants are described. Author

N70-17434# Institute of Technology, Helsinki (Finland).

ON THE DEFORMATIONS AND STIFFNESS PROPERTIES OF REINFORCED CONCRETE MEMBERS IN FLEXURE UNDER WORKING CONDITIONS

T. Rechardt (Ph.D. Thesis) 1969 15 p refs *Its* Julkaisu 150 publ.

Avail: CFSTI

The feasibility of simulating the behavior of reinforced concrete members in flexure using a theoretical model was determined. The model was based on the following assumptions: (1) the stress-strain curve of the concrete is stipulated both in compression and in tension, (2) the stress-strain curve of the steel reinforcement is known, and (3) the strains at various levels in a section are assumed to be directly proportional to the distance from the neutral axis. Analytical expressions derived from the model were used to obtain moment-curvature and moment-rotation relationships. The validity of these theoretical considerations was examined by testing twelve fixed-end reinforced concrete beams. Results show that the theoretical bending-moment distribution conformed with fair accuracy to the actual distribution. D.L.G.

N70-17443 National Lending Library for Science and Technology, Boston Spa (England).
BIREFRINGENCE OF FILMS OBLIQUELY DEPOSITED BY EVAPORATION [DOPPELBRECHUNG SCHRAEG AUFGEDAMPFTER SCHICHTEN]
E. Neugebauer et al 10 Sep. 1969 15 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 29, no. 2, 1969 p 150–161
(NLL-T-6465-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

It has been known for a long time that obliquely deposited films are subject to birefringence to a greater or lesser extent. The nature of birefringence is accurately examined in the present study with the aid of an example (WO3 and MoO3). Films obliquely deposited by evaporation of tungsten oxide and molybdenum oxide behave like an optically biaxial crystal, the maximum birefringence (at an evaporation angle of 9 deg) reaching approximately that of calcite. One of the optic axes is perpendicular or almost normal to the film surface. With increasing obliquity of the direction of evaporation the mean refractive index of the film decreases at an increasing rate and closely approaches unity. A few engineering applications are discussed. Author

N70-17459# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.
THE EFFECT OF HYDROSTATIC PRESSURE ON THE FIBRE-MATRIX BOND
P. B. Bowden Nov. 1969 12 p refs
(NPL-IMS-6) Copyright. Avail: CFSTI

The properties of fibre reinforced composite materials are critically dependent on the breaking stress of the bond between fiber and matrix, and also on the friction stress at the fiber matrix interface during pull-out after the bond is broken. The object of this investigation was to measure both these quantities in a model system as a function of applied hydrostatic pressure. More information about the processes operating is thus obtainable and it is also found that in actual fiber composites the stress at the interface can have a hydrostatic component which is likely to affect the properties of the interface and hence the properties of the composite. The particular system investigated was a steel wire embedded in epoxy resin. Author (ESRO)

N70-17601*# Washington Univ., Seattle.
A STUDY OF THE IMPACT OF THE CERAMIC MATERIALS RESEARCH PROGRAM AT THE UNIVERSITY OF WASHINGTON Final Report, 15 Jun. 1968 – 15 Sep. 1969
Fremont E. Kast, James E. Rosenzweig, and John W. Stockman 15 Nov. 1969 93 p refs
(Grant NGL-48-002-004)
(NASA-CR-107863) Avail: CFSTI CSCL 11B

The impact of federally sponsored research programs on universities was studied. Specifically the impact of the Ceramic Materials Research Program (CMRP) on the University of Washington was investigated at three levels: the Ceramic Engineering Division, the College of Engineering, and the University. The administrative, organizational, and structural relationships of the CMRP are identified, and a social-phychological analysis of the attitudes, opinions, and reaction of the various participants in the CMRP is included. The results of the study indicate that the CMRP has had an overall positive effect on all levels of interest. Students, faculty participants, and university administrators responded favorably to questionnaires. The number of graduate students increased substantially during the period, and significant contributions to scientific knowledge were made. F.O.S.

N70-17670# Rensselaer Polytechnic Inst., Troy, N.Y.
PREPARATION AND ELECTRICAL PROPERTIES OF MIXED SELENIDE-OXIDE GLASSES
James Edward Land (Ph.D. Thesis) 1968 179 p refs
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-6468

Several semiconducting oxychalcogenide glasses were prepared from mixtures of arsenic selenide and various metal oxides. Homogeneous glasses were produced from arsenic selenide-copper oxide compositions up to a copper oxide content of 50 mole percent. The electrical conductivity at 25 deg C of these glasses increased in a logarithmic fashion. Based on the results of measurements of electrical properties as well as physical properties such as density and thermal expansion, the arsenic selenide-copper oxide (oxychalcogneide) glasses resemble conventional chalcogenide glasses rather than typical transition metal oxide glasses. Dissert. Abstr.

N70-17682# Institute of Technology, Helsinki (Finland).
ON THE BEHAVIOUR OF HARDENED CONCRETE DURING FREEZING. EXPERIMENTAL STUDIES ON THE APPLICATION OF THE ONE-CYCLE FREEZING TEST IN COMBINATION WITH POROSITY DETERMINATIONS FOR THE EVALUATION OF THE FREEZING AND THAWING RESISTANCE OF HARDENED CONCRETE
Jukka Vuorinen (Ph.D. Thesis) 1969 134 p refs *Its* Julkaisu 145 Publ.
Avail: CFSTI

Tests were conducted to determine: (1) the magnitude of dilation or the difference between the relative length change of test specimen over the temperature range of 20 to 0 C and the final length change of the specimen over the temperature range of 0 to –20 C (2) the pore ratio or the ratio of the air-filled pore volume to the total pore volume of the concrete after storage in water. Determinations were also made of the durability factor, based on a total of 50 cycles of freezing and thawing, and frost damage, based on the loss in the dynamic modulus of elasticity and the permanent change in length per cycle. Variables included the type of specimen (cylinder or prism) and the curing procedure (with or without oven-drying at 105 C). The later variable had a significant influence on the results. Analysis of test data reveals correlations of practical value between the durability factor and pore ratio and/or the dilation factor for evaluating the potential frost resistance of concrete. The best results were obtained with the drying phase included in the testing procedure. D.L.G.

N70-18121# Pennsylvania State Univ., University Park.
DYNAMIC STRESS-STRAIN BEHAVIOR OF ENGINEERING MATERIALS Final Report, 1 Jul. 1961 – 20 Jun. 1968
M. G. Sharma and V. H. Neubert Oct. 1969 13 p refs
(Contract DA-31-124-ARO(D)-116)
(AD-696507; AROD-3263-17-E) Avail: CFSTI CSCL 20/11

A brief review is given of a study of the dynamic mechanical behavior of various polymeric materials through dynamic experiments involving the application of sinusoidally varying loads. Various polymeric materials including glassy polymers, elastomers and filled rubber-like materials were studied. In addition, the report includes a review of a study involving experimental measurement of behavior of materials in various configurations with parallel development of theoretical approaches and numerical analysis procedures for the associated boundary value problems. The report also includes a bibliography of publications. Author (TAB)

N70-18140# International Atomic Energy Agency, Vienna (Austria).
URANIUM CARBIDES, NITRIDES, AND SILICIDES, VOLUME 3 (1966 – 1967)
1968 110 p refs *Its* Bibliographical Ser. No. 33
(STI/PUB-21/33-Vol-3) Avail: AEC Depository Libraries

A bibliography of 520 references to the literature published during the period 1966 – 1967 is presented. Most references are provided with abstracts in English. The main bibliographical sources were: Nuclear Science Abstracts, Referativnyi Zhurnal-Khimiya, Chemical Abstracts, and Nuclear Science Abstracts of Japan. For ease of reference an author index and a subject index are included. Author (NSA)

N70-18212# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
RATE OF PROPAGATION OF ULTRASOUND AND THE STRUCTURE OF GLASSES IN THE SYSTEMS SeAs, S-As AND Se-Ge
A. P. Chernov et al May 1969 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR. Neorgan. Materialy (USSR), v. 4, no. 10, 1968 p 1658–1663 Sponsored by MIT, Lincoln Lab.
(Rept-173-69-394-RULL) Avail: CFSTI

The rate of propagation of ultrasound and the elastic modules are investigated by an impulse method as functions of composition in the binary vitreous systems Se-As, S-As and Se-Ge, and in crystal samples obtained by annealing glass. Results are tabulated, and a discussion of the results is included. It is concluded that the rate of propagation of ultrasound for some structural units is a function of composition, and the rate of propagation of ultrasound in vitreous selenium and glasses, doped with sulfur is less than in the chemical compounds having a trigonally or tetrahedrally linked space shell of the bonds. F.O.S.

N70-18221# National Center for Atmospheric Research, Boulder, Colo.
BALLOON FILM PERFORMANCE AFTER PRIOR STRESS
Jan. 1970 57 p refs
(NCAR-TN-46) Avail: CFSTI

Data from uniaxial and biaxial tests at +25 and −80 C clearly demonstrate that prior loading of polyethylene balloon film does not decrease the ultimate strength of the material. Local yielding of the balloon film compensates for areas of stress concentration whose magnitude exceeds the yield strength, without failure of the material. Author

N70-18247# Southwest Research Inst., San Antonio, Tex.
EXPERIMENTAL VERIFICATION OF A METHOD FOR IMPROVING THE DYNAMIC PROPERTIES OF A PLASTIC FOAM PACKAGING SYSTEM Final Report
W. E. Woolam Jan. 1970 17 p
Avail: CFSTI

Studies were conducted on the dynamics of low energy plastic cushioning materials in which two plastic foams of different dynamic properties were combined in a series and in parallel combination to improve the overall cushioning ability. A piezoelectric accelerometer, used to measure the impact g levels, an oscilloscope, and polaroid camera were used to record the signature of the deceleration in the experiments. The application of a two or three layer foam to the padded surface of automobile dashes is discussed. J.M.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-16908*# Wisconsin Univ., Madison. Mathematics Research Center.
STOCHASTIC INTEGRALS FOR PROCESSES WITH COVARIANCE
L. C. Young Sep. 1968 41 p
(NGR-50-002-040; DA-31-124-ARO(D)-462)
(NASA-CR-107752; AD-689432; MRC-TSR-932) Avail: CFSTI CSCL 12A

The report extends the notion of the stochastic integral. The integrand is taken to be a deterministic function belonging to one or more integrated Lipschitz classes; the stochastic process, with respect to which one integrates is one for which the covariance between non-overlapping fine intervals, and that between an interval and itself, are subject to certain inequalities. TAB

N70-16938# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
NOTE ON AN ASYMPTOTIC PROPERTY OF SOLUTIONS TO A CLASS OF FREDHOLM INTEGRAL EQUATIONS
Rokuro Muki and Eli Sternberg Oct. 1969 15 p refs
(Contract Nonr-220(58))
(AD-696642; TR-19) Avail: CFSTI CSCL 12/1

The note concerns a class of inhomogeneous integral equations of Fredholms second kind on a semi-infinite interval. The dominating asymptotic behavior at infinity of the solution to such an equation is determined from the corresponding known asymptotic properties of its kernel and right-hand member. Author (TAB)

N70-16939# Mitre Corp., Bedford, Mass.
THE IMPLICATIONS OF ADP NETWORKING STANDARDS FOR OPERATIONS RESEARCH
Paul L. Peck Jun. 1969 22 p refs
(Contract F19628-68-C-0365)
(AD-696675; MTP-333) Avail: CFSTI CSCL 12/2

The report discusses the aspects of data processing which have hindered the integration of operations research capabilities in large decentralized organizations. Networking is proposed as a means of promoting OR integration, the factors which have inhibited successful networking are discussed, and ADP standardization is suggested as a means of overcoming existing limitations. Author (TAB)

N70-16976# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
A NEW ITERATIVE PROCEDURE FOR THE MINIMIZATION OF A QUADRATIC FORM ON A CONVEX SET
Thomas Pecsvaradi and Kumpati S. Narenda Jun. 1969 11 p refs
(CT-28) Avail: CFSTI

An iterative procedure is developed for computing the minimum of a quadratic form on a compact convex set R in Euclidean n-space. Each of the polyhedra used is the convex hull of (n+2) points belonging to R. Author

N70-16977# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
REACHABLE SETS FOR LINEAR DYNAMICAL SYSTEMS
Thomas Pecsvaradi and Kumpati S. Narendra Jul. 1969 25 p refs
(CT-29) Avail: CFSTI

The concept of reachability and the structure and properties of the reachable and controllable sets for linear time varying systems are investigated. Formalskii results are extended to linear time varying multi-input systems for the determination of boundary points of the reachable set. Iterative procedures are developed for determining the reachability for a specific state and for estimating the reachable set. Author

N70-16985# Iowa Univ., Iowa City. Dept. of Mathematics.
UNIFORM ENUMERATION OPERATIONS
Alistair H. Lachlan Oct. 1969 32 p refs
(Contract N00014-68-A-0500; Proj. Theme)
(AD-696952; UI-TR-15) Avail: CFSTI CSCL 12/1

Operations are considered, such as the jump operation on the degrees of unsolvability. Let phi be an operation mapping sets of natural numbers into sets of natural numbers such that phi (X) is uniformly recursively enumerable in X. Let phi be such that if reductions of A to B and vice-versa are given then reductions of phi (A) to phi (B) and vice-versa can be found effectively. The operation that phi induces on the degrees of unsolvability is called a 'uniform enumeration operation.' Several properties of such operations are found. Author (TAB)

N70-17001# Technion - Israel Inst. of Tech., Haifa. Faculty of Industrial and Management Engineering.
SORTING FEASIBLE BASIC SOLUTIONS OF A LINEAR PROGRAM

M. A. Pollatschek and B. Avi-Itzhak May 1969 37 p refs /ts Mimeograph Ser. No. 44
(Contract F61052-68-C-0014)
(AD-693996) Avail: CFSTI CSCL 12/2

An algorithm for sorting feasible basic solutions of a linear program is proposed. The algorithm proceeds from one basic solution to the next in order of non-increasing values of the objective function. The use of the proposed procedure is demonstrated through numerical examples and geometrical interpretations. The algorithm solves problems where a basic feasible solution is sought, maximizing a linear objective function and satisfying some prescribed conditions. This category includes the fixed-charge problem, the travelling salesman-problem, the mixed 0,1 linear program, etc. Author (TAB)

N70-17005# Wisconsin Univ., Madison. Mathematics Research Center.
A SIMPLE PROOF OF A RESULT OF KESTEN AND STIGUM ON SUPERCRITICAL MULTITYPE GALTON – WATSON BRANCHING PROCESSES Technical Summary Report
Krishna B. Athreya May 1969 18 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-696926; MRC-TSR-984) Avail: CFSTI CSCL 12/1

The paper gives a new and simple proof of a key result due to Kesten and Stigum in the theory of supercritical multitype Galton-Watson branching process. TAB

N70-17019# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
DENSE SETS OF TWO VARIABLE INTEGER PROGRAMS REQUIRING ARBITRARILY MANY CUTS OF FRACTIONAL ALGORITHMS
R. G. Jeroslow and K. O. Kortanek Aug. 1969 32 p refs
(Contract Nonr-760(24))
(AD-696950; RR-174) Avail: CFSTI CSCL 12/2

A class of two variable integer programming problems is defined which are indexed by a continuous parameter $t > 0$. It is then shown that, given any non-empty open interval I of positive reals and any number N, there can be found a rational value (t_0) is an element of I, such that the problem indexed by (t_0) requires at least N cuts before convergence to the integer optimal occurs, using the algorithm of Gomory based on the fractional row cut. This result is derived as a corollary to the main theorem of the paper, which states an entirely parallel result for any Generalized Fractional Algorithm (GFA), a notion defined in the paper and shown to include the algorithm of Gomory as a special case. While the definition of a GFA is very broad, it does not permit the possibility of adding the entire group of cuts to the tableau at each iteration. TAB

N70-17023# Stanford Univ., Calif. Dept. of Statistics.
CONFIDENCE LIMITS FOR THE EXPECTED VALUE OF AN ARBITRARY BOUNDED RANDOM VARIABLE WITH A CONTINUOUS DISTRIBUTION FUNCTION
T. W. Anderson 1 Oct. 1969 10 p refs
(Contract N00014-67-A-0112)
(AD-696676; TR-1) Avail: CFSTI CSCL 12/1

Consider a random variable X with a continuous cumulative distribution function F(x) such that $F(a) = 0$ and $F(b) = 1$ for known finite numbers a and b ($a < b$). The distribution function F(x) is unknown. A sample of size n is drawn from this distribution. Confidence limits for the expected value EX are to be found that hold for all continuous distribution functions with (a, b). Author (TAB)

N70-17038# Wisconsin Univ., Madison. Mathematics Research Center.
PERTURBATIONS OF NONLINEAR SYSTEMS OF DIFFERENTIAL EQUATIONS, 3
Fred Brauer and Aaron Strauss Jul. 1969 21 p refs
(Contracts DA-31-124-ARO(D)-462; DA-31-124-ARO(D)-286; Grant NSF GP-8914)
(AD-696923; MRC-TSR-977) Avail: CFSTI CSCL 12/1

Several perturbation theorems are proved for nonlinear ordinary differential systems $x' = f(t,x)$ for which the zero solution is uniformly stable in variation. Author (TAB)

N70-17063# RAND Corp., Santa Monica, Calif.
POWER SERIES AND THE NUMERICAL TREATMENT OF INITIAL VALUE PROBLEMS
J. L. Casti Sep. 1969 33 p refs
(Contract F44620-67-C-0045; Proj. RAND
(AD-696115; RM-6059-PR) Avail: CFSTI CSCL 12/1

The report examines power series methods for computing the solution to an initial-value problem at a few isolated points with moderate to excellent accuracy. Recursion formulas for determining the coefficients in several power series are developed for easy implementation on a digital computer. Consideration is also given to methods for accelerating series convergence, for obtaining asymptotic values, and for treating quadratically nonlinear systems of equations. Several numerical experiments are performed to test the efficacy of the proposed methods. Results include a complete set of PL/1 programs suitable for obtaining power series solutions for scalar initial-value problems as well as for the quadratic multidimensional case. Author (TAB)

N70-17069# Iowa Univ., Iowa City. Dept. of Mathematics.
DECISION PROBLEMS IN GROUP THEORY
Andrzej W. Mostowski Nov. 1969 101 p refs Presented at Iowa City, Iowa, 23 Sep. – 21 Oct. 1969
(Contract N00014-68-A-0500; Proj. Themis)
(AD-696955; UI-TR-19) Avail: CFSTI CSCL 12/1

The report is primarily an exposition of current material on the presentation of groups with particular attention given to the word problem and to algorithms for effective computations. Author (TAB)

N70-17071# California Univ., Riverside. Dept. of Mathematics.
MATHEMATICAL RESEARCH IN APPLIED MATHEMATICS Final Scientific Report, 1 Jul. 1967 – 14 Aug. 1968
Frederic T. Metcalf and J. Keith Oddson 4 Nov. 1969 7 p refs
(Grant AF-AFOSR-1122-67)
(AD-697042; AFOSR-69-2866TR) Avail: CFSTI CSCL 12/1

The paper is a review and bibliography of the work done in applied mathematics in such areas as differential equations, approximation theory, and inequalities. TAB

N70-17073# Wisconsin Univ., Madison. Mathematics Research Center.
INEQUALITIES FOR GENERALIZED CONVEX FUNCTIONS
Zvi Ziegler May 1969 24 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-696924; MRC-TSR-980) Avail: CFSTI CSCL 12/1

A recently developed technique is summarized which is useful for the systematic study of linear inequalities valid for functions possessing certain convexity properties. Some of the problems under current investigation are discussed, several new applications are listed and open problems are suggested. TAB

N70-17078# Syracuse Univ., N.Y. Dept. of Mathematics.
THEORY OF APPROXIMATION Final Report, 1 Jul. 1968 – 1 Jul. 1969
G. G. Lorentz 1 Jul. 1969 3 p refs
(Contract AF 49(638)-1401)
(AD-697048; AFOSR-69-2923TR) Avail: CFSTI CSCL 12/1

The publication reviews briefly the papers that were published during the reporting period in areas of Analysis (Mathematics). TAB

N70-17090# IBM Watson Research Center, Yorktown Heights, N.Y.
ON THE NUMBER OF MULTIPLICATIONS NECESSARY TO COMPUTE CERTAIN FUNCTIONS
Shmuel Winograd 15 Nov. 1968 21 p refs Sponsored in part by ONR
(AD-696645; RC-2285) Avail: CFSTI CSCL 12/1

The number of multiplications and divisions required in certain computations is investigated. In particular, results of Pan Motzkin, about polynomial evaluation as well as similar results about the product of a matrix by vector, are obtained. As an application of the results on the product of a matrix by vector, a new algorithm for matrix multiplication, which requires about 1/2(n cubed) multiplications, is obtained. Author (TAB)

N70-17096# Harvard Univ., Cambridge, Mass. Dept of Statistics.
THE ENUMERATIVE USES OF GENERATING FUNCTIONS
Edward A. Bender (Institute for Defense Analyses) and Jay R. Goldman 29 Sep. 1969 23 p refs Prepared in cooperation with Inst. for Defense Analyses
(Contract N00014-67-A-0298-0017)
(AD-696143; TR-27) Avail: CFSTI CSCL 12/1

Objects may be viewed as a product of prime objects in such a way that the appropriate type of generating function is immediately suggested by the combinatorial problem. Many graph theory formulae (rooted trees, chromatic labeled graphs, etc.) follow easily. Other immediate consequences are e to the power e to the power x – 1 for partitions of a set, and the enumeration of direct sum decompositions of finite vector spaces. Author (TAB)

N70-17105# Columbia Univ., New York. Operations Research Group.
ON OPTIMAL BALKING RULES AND TOLL CHARGES IN THE GI/M/1 QUEUEING PROCESS
Uri Yechiali 1 Sep. 1969 77 p refs
(Contract N00014-67-A-0108-0008)
(AD-696798; TR-47) Avail: CFSTI CSCL 12/2

A GI/M/1 queueing process with an associated linear cost-reward structure and stationary balking process is considered. Based on the probabilistic analysis of the system optimal joining rules for an individual arrival, as well as for the entire community of customers, are derived. It is shown that among all stationary policies the optimal strategies are control limit rules of the form: join if and only if the queue size is not greater than some specific number. However, it is found that, in general, exercising self-optimization does not optimize public good. Accordingly, the idea of controlling the queue size by levying tolls-- thus achieving the systems overall optimal economic performance - is explored. Finally, a competition model in which customers face a service agency which is a profit making organization is analyzed, and shown to be similar to the monopoly model of price theory. Author (TAB)

N70-17134# System Development Corp., Santa Monica, Calif.
ESTIMATION OF THE DEPARTURE FROM ABSOLUTE CONTINUITY OF A DISTRIBUTION
Vrudhula K. Murthy 20 Oct. 1969 20 p refs
(AD-696648; SDC-SP-3430) Avail: CSCL 12/1

In a previous paper (1965), the author has treated the problem of estimating the jumps of the probability distribution function. In this paper, the author proposes the sum of the squares of the jumps as a criterion of departure from absolute continuity of the diatribution function and then solves the problem of estimation based on a random sample. TAB

N70-17148# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
A MULTIPLE-DECISION APPROACH TO THE SELECTION OF THE BEST SET OF PREDICTOR VARIATES
John Schmidt Ramberg Jul. 1969 110 p
(Contracts DA-31-124-ARO(D)-4-14; Nonr-401(53))
(A&-696128; TR-79) Avail: CFSTI CSCL 12/1

Some indifference zone multiple-decision selection procedure formulations of prediction problems involving multivariate normal populations are considered. These problems are of two types. Part I considers problems involving k bivariate normal populations, where the goal is to select the best population. In this part the goodness of the prediction is measured in terms of three different parameters -- the population conditional variance, the population correlation coefficient, and the absolute value of the population correlation coefficient. Part II considers the problem of selecting the best set of s preassigned number t variates from a set of k predictor variates for predicting a designated variate, the predictand. The best set of predictor variates is defined to be the set of t variates for which the predictand has the smallest population conditional variance (or equivalently the largest population multiple correlation coefficient). Sample size requirements are obtained using asymptotic distribution theory of the transformed statistics. TAB

N70-17151# Boeing Scientific Research Labs. Seattle, Wash. Mathematics Research Lab.
SOME UNSOLVED PROBLEMS CONCERNING CONVEX BODIES
Victor Klee Sep. 1969 30 p refs *Its* Mathematical Note 0103
(Contract N00014-67-A-0103)
(AD-696970; DI-82-0905) Avail: CFSTI CSCL 12/1

The document contains five unrelated articles, each providing an exposition of certain unsolved problems concerning convex bodies. The titles of the five articles are as follows: Is a body spherical if its HA-measurements are constant, What is the expected volume of a simplex whose vertices are chosen at random from a given convex body, Can the boundary of a d-dimensional convex body contain segments in all directions, What are the intersection graphs of arcs in a circle, and What is the maximum length of a d-dimensional snake. The problem of the first article is related to solid-state physics, of the second to the analysis of multicomponent phase diagrams, of the to approximation theory, of the fourth to molecular genetics, and of the fifth to the design of analog-to-digital conversion systems. These relationships are described in the articles. TAB

N70-17158# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
GENERALIZED FUNCTIONS OF MATRIX POWERS Final Scientific Report
Paul J. Nikola Jul. 1969 42 p refs
(AD-697031; ARL-69-0117) Avail: CFSTI CSCL 12/1

The generalized matrix functions of Issai Schur are studied. Inequalities and limit theorems are obtained in case of positive semidefinite hermitian matrices. Corresponding limit theorems for nonnegative irreducible matrices are also developed. Author (TAB)

N70-17168# Texas Univ., Austin. Electronics Research Center.
THE IDENTIFICATION OF A CLASS OF NONLINEAR CONTROL SYSTEMS BY ELIMINATION REGRESSION
James H. Hinderer and B. F. Womack 14 Mar. 1969 123 p refs
(Contract F41609-68-C-0020; Grant AF-AFOSR-706-67)
(AD-696638; AFOSR-69-0641TR; TR-61) Avail: CFSTI CSCL 12/1

Work in nonlinear control system identification has proceeded slowly because a general technique for solving nonlinear differential equations is not known. Many techniques have been developed in nonlinear identification, but most are oriented toward small classes of problems rather than toward the large class of all nonlinear systems with lumped elements. A motivation for the work has been to develop one of these techniques further than it has been developed and to do so preferably in a manner that will create an

identification scheme that is simple to apply. Identification by regression methods was the technique chosen for investigation. Elimination regression can be applied in the identification of man-made and biological control systems, in modeling problems, and in supplementing other identification techniques. Elimination regression is illustrated in an application to a computer-generated problem involving a second-order system. The potential for extension to systems other than those described in the problem statement is demonstrated in a biological modeling problem. The latter problem is a part of the larger problem of modeling the relation between heart rate and respiration. TAB

N70-17169# Illinois Univ., Urbana. Coordinated Science Lab.
SEGMENT METHOD FOR THE CONTROL OF SYSTEMS IN THE PRESENCE OF UNCERTAINTY
J. Medanic and Chen, Cheng-I Nov. 1969 29 p refs
(Contract DAAB07-67-C-0199; Grants AF-AFOSR-931-67; AF-AFOSR-1579-68; NSF GK-3893)
(AD-606785; R-442) Avail: CFSTI CSCL 12/1

The paper develops the segment method for the problem of control with uncertainty. It is shown that due to disturbances a segment of values of the performance functional is associated with each admissible control. It is proposed that the optimal control for the problem with uncertainty be defined on the basis of an ordering of associated segments. The ordering is achieved by introducing a segment index. Two particular segments, the pessimistic and the optimistic segment, are shown to be important in the analysis of the problem while minimization of the introduced segment index is the basic synthesis problem. The approach is applied to a linear control problem where uncertainty is caused by external disturbances and specific results are presented. They show the optimal control to retain the advantages of the usual, minimax type designs and ensure better system performance for disturbances other than the worst. Author (TAB)

N70-17170# California Univ., Los Angeles. Dept. of System Sciences.
ON SYSTEM PARAMETER IDENTIFIABILITY
R. M. Staley and P. C. Yue Oct. 1969 17 p refs
(Grants AF-AFOSR-1328-67; NSF G-2032)
(AD-696157; AFOSR-69-2691TR) Avail: CFSTI CSCL 12/1

The paper establishes two concepts of identifiability for the unknown parameters of linear, constant, stable, discrete-time dynamic systems. Necessary and sufficient conditions are obtained for the system parameters to be identifiable in the deterministic sense and stochastically identifiable. These conditions are shown to be significant in studying the asymptotic properties of maximum likelihood estimators. Generalizations of these concepts to include the identification of the systems initial state are also discussed. Author (TAB)

N70-17198# Arizona Univ., Tucson. Dept. of Mathematics.
MATHEMATICAL PROBLEMS IN CLASSICAL PHYSICS Final Report, 1 Jan. - 31 Aug. 1969
Calvin H. Wilcox 20 Oct. 1969 8 p refs
(Contract N00014-67-A-0209)
(AD-696144; FR-2) Avail: CFSTI CSCL 12/1

The report gives a brief summary of work completed under the contract, in the mathematical analysis of wave propagation. TAB

N70-17202# Stanford Univ., Calif. Dept. of Computer Science.
EMPIRICAL EVIDENCE FOR A PROPOSED DISTRIBUTION OF SMALL PRIME GAPS
Richard P. Brent 28 Feb. 1969 22 p refs Sponsored in part by NSF
(Contract N00014-67-A-0112)
(AD-696982; CS-123) Avail: CFSTI CSCL 12/1

The distribution of small gaps between adjacent prime numbers is studied. A model for this distribution is derived from probability arguments. Empirical evidence strongly supports this model. An asymptotic density function for twin primes is suggested, and support is given to the conjecture that there is an infinity of twin primes. Author (TAB)

N70-17229# Institute of Technology, Helsinki (Finland).
ON SOME NONLINEAR VOLTERRA EQUATIONS
Stig-Olof Londen (Ph.D. Thesis) 1969 79 p refs *Its* Ser. A, 6 Phys. 317
Avail: CFSTI

The behaviour, as t approaches the limit of infinity, of solutions of a class of nonlinear integrodifferential equations of Volterra type. Results, concerning the existence of bounded solutions are derived. The validity of some numerical methods for obtaining approximate solutions of a class of nonlinear integral equations of Volterra type is analyzed. Applications to reactor dynamics are considered. Author

N70-17238# Wisconsin Univ., Madison. Mathematics Research Center.
EFFICIENT LINEARIZED ESTIMATES BASED ON RANKS
Charles H. Kraft and Constance van Eeden Aug. 1969 13 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-606928; MRC-TSR-996) Avail: CFSTI CSCL 12/1

Efficient estimates of location parameters, which are based on rank tests and which can be computed from a single ranking of the observations, are studied. Author (TAB)

N70-17244# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
LECTURES ON MODULAR FORMS
Joseph Lehner Dec. 1969 77 p refs *Its* Appl. Math. Ser. 61
Avail: SOD $0.70 Catalog No. C-13.32:61

This book is an expository account of the theory of modular forms and its application to number theory and analysis. Modular forms are defined and their most important properties developed. The Hecke modular forms are introduced. A Hecke form f is a simultaneous eigenfunction of a family of linear operators T sub p, where p runs over the positive primes. The eigenvalue corresponding to T sub p is the pth Fourier coefficient a(p) of f. The Fourier coefficients of f are multiplicative, i.e., a(mm) = a(m)a(n) when m and n have no common divisors. The intimate connection of these results to the theory of certain zeta-functions is indicated in a note to chapter 3. The automorphisms of a compact Riemann surface are discussed. It is shown what groups of linear-fractional transformations with coefficients in a finite field can be the group of automorphisms of a compact Riemann surface. Congruences and other arithmetic properties are developed for the Fourier coefficients of Klein's absolute modular invariant. Analogies with the Hecke theory as well as with the Ramanujan congruences for the partition function are discussed. Author

N70-17285# Technion - Israel Inst. of Tech., Haifa. Faculty of Industrial and Management Engineering.
QUEUEING PROBLEMS WITH HETEROGENEOUS ARRIVALS AND SERVICE
U. Yechiali and P. Naor Jul. 1969 23 p refs *Its* Mimeograph Ser. No. 49
(Contract F61052-68-C-0014)
(AD-694032) Avail: CFSTI CSCL 12/2

A two-level modification of the M/M/1 queuing model is studied where the rate of arrival and the service capacity are subject to Poisson alternations. The ensuing (two-dimensional) problem is analyzed by the use of partial generating function techniques which appear to be essential in the present context. The steady state probabilities and the expected queue are evaluated and numerous special and extreme cases are analyzed in detail. Author (TAB)

N70-17322# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
REMARKS ON THE RETARDED AND ADVANCED GREEN'S FUNCTIONS
J. G. Ramos and A. A. Gomes 1969 14 p refs *Its* Notas de Fisica V. 15, No. 14
Avail: CFSTI

The connection between time correlation and retarded, advanced Green's functions is discussed systematically. The occurence of a time independent contribution to the time correlation function is connected to commutator defined Green's function, and a simple rule is given for its calculation when a suitable decoupling is available. Author

N70-17369# National Aerospace Lab., Tokyo (Japan).
DIFFERENCE METHOD FOR THE NAVIER-STOKES EQUATION
Hajime Miyoshi 1969 25 p refs In JAPANESE
(NAL-TR-174) Avail: CFSTI

The purpose of this paper is to construct several difference schemes for the one dimensional unsteady Navier-Stokes equation and to examine their stability properties by means of V. Neumann's error analysis and numerical experiment. It is found that the usual explicit parabolic schemes have a strong restriction for its practical use and that a mixed hyperbolic-parabolic explicit scheme has the stability properties which are a combination of the usual parabolic and hyperbolic stability criterions from the practical point of view. In the last section of this paper, it is shown that the scheme, having non-symmetric difference approximation for the second order space derivative, has a good property with respect to the stability criterion. Author

N70-17610# Washington Univ., Seattle. Dept. of Mathematics.
RESEARCH IN NUMERICAL ANALYSIS Final Scientific Report, 16 Jun. 1968 – 15 Jun. 1969
A. A. Goldstein 10 Oct. 1969 8 p refs
(Contract AF-AFOSR-937-67)
(AD-697094; AFOSR-69-2889TR) Avail: CFSTI CSCL 12/1

The research for this period was mainly in the fields of applied functional analysis. The topics of applied functional analysis which were investigated in research papers were: Theory of vector-valued eigenvalues, Non-linear functional analysis, Optimal control theory, Convex programming, Mechanical cubature, Approximation theory, Iteration techniques for non-linear operators, Linear programming theory in partially ordered vector spaces, and partial differential equations. Author (TAB)

N70-17611# Ohio State Univ. Research Foundation, Columbus.
ON A GENERALIZATION OF THE EXPONENTIAL INTEGRAL Final Scientific Report
Carl Kaplan Wright-Patterson AFB, Ohio ARL Jul. 1969 31 p refs
(Contract F33615-67-1758)
(AD-696682; ARL-69-0120) Avail: CFSTI CSCL 12/1

The subject matter of this paper evolved during the process of finding the asymptotic form of the stream function for the flow of an Oseen-like fluid past a paraboloid of revolution. Certain simple-appearing ordinary differential equations of the second order had to be solved in order to obtain the second and third approximations to the stream function and led in a natural way to a generalization of the exponential integral. The definitions of these generalized exponential integrals, their asymptotic and series expansions, the recurrence relations and derivatives parallel those of the well-known exponential integrals. Author (TAB)

N70-17637*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
ASYMPTOTIC INDEPENDENCE BETWEEN LARGEST AND SMALLEST OF A SET OF INDEPENDENT OBSERVATIONS
John E. Walsh 4 Oct. 1968 7 p
(Grant NGR-44-007-028)
(NASA-CR-107897; TR-17) Avail: CFSTI CSCL 12/1

Let X sub N and X sub L be the largest and smallest order statistics, respectively, of a set of N independent univariate observations. Under rather general conditions, with respect to the distributions of the individual observations, X sub N and X sub L are asymptotically independent. However, asymptotic independence does not occur for all cases. Author (TAB)

N70-17876# Wisconsin Univ., Madison. Mathematics Research Center.
REMARKS ON THE DIRICHLET PROBLEM FOR LINEAR ELLIPTIC DIFFERENTIAL EQUATIONS
J. Drahman and P. Werner Jul. 1969 71 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-696324; TSR-979) Avail: CFSTI CSCL 12/1

The distribution-theoretical approach to the theory of the Hilbert space L sub 2 which has been developed by one of the authors in a previous paper is applied to the Dirichlet problem for linear elliptic differential equations of arbitrary order. Author (TAB)

N70-17877 Missouri Univ., Columbia.
DISCRETE PROGRAMMING AND ENGINEERING DESIGN
John Astor Dearien, Jr. (Ph.D. Thesis) 1968 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-3374

This dissertation presents an algorithm by which a linear convex solution space can be searched to obtain a solution minimizing an objective function. The algorithm allows the user to specify in advance the set of values from which the final solution is to be selected. The character of the set of admissible values can vary with each variable. Some could be chosen from the integer set, others from a set supplied by the user, and still others from the continuous set. The Simplex method of linear programming is discussed and a geometrical interpretation of the linear programming method is presented that is relevant to the developed algorithm. The searching algorithm is developed and presented with a geometric and mathematical description of the procedure. Dissert. Abstr.

N70-17879# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
GENERAL FORMULATION OF GRIFFITHS' INEQUALITIES
J. Ginibre Nov. 1969 31 p refs
(Rept-69/65) Avail: CFSTI

A general framework is presented in which Griffiths inequalities on the correlations of ferromagnetic spin systems appear as natural consequences of general assumptions. A method is given for the construction of a large class of models satisfying the basic assumptions. Special cases include the Ising model with arbitrary spins, and the plane rotator model. The general theory extends in a straightforward way to the noncommutative (quantum) case, but non-commutative examples satisfying all the assumptions are lacking at the moment. Author

N70-17911# Minnesota Univ., Minneapolis. School of Mathematics.
FUNCTIONAL ANALYSIS AND STOCHASTIC PROCESSES Final Technical Report, 1 Jul. 1968 – 30 Jun. 1969
R. H. Cameron, H. Furstenberg, B. N. Jamison, W. E. Pruitt, and D. A. Storvick 4 Aug. 1969 9 p refs
(Grant AF-AFOSR-381-68)
(AD-696155; AFOSR-69-2654TR) Avail: CFSTI CSCL 12/1

Research was continued in the areas of Wiener and Feynman integrals, analytic functions of several complex variables, ergodic theory, and Markov and other stochastic processes. Author (TAB)

N70-17912 Michigan State Univ., East Lansing.
A STATE-VARIABLE APPROACH TO TIME-VARYING EQUIVALENT NETWORKS

Peter John Graham (Ph.D. Thesis) 1968 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-5873

Two networks are equivalent with respect to some network function F(s). These networks are said to belong to a set of continuously equivalent networks if the components of either of the networks can be changed continuously in a manner that will ultimately yield the other network such that the continuum of networks produced in the process all possess the same network function F(s). The state-variable characterization was used to introduce a class of continuously equivalent networks. A set of differential equations describing how the components should be varied was proved sufficient to assure equivalence. Practical solutions of the equivalence differential equations are defined. It is shown that complex poles can be realized by such networks with component variations which are all periodic and nonnegative. Dissert. Abstr.

N70-17914 New Mexico Univ., Albuquerque.
ON THE FOUNDATIONS OF LARGE DEFORMATION SHELL THEORY
Raymond David Krieg (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-9256

The basic definitions and concepts of shell theory are presented in a more general and more rigorous manner than usual. The definitions by W. Noll of the body and its configurations are used as a basic starting point. The body is considered as the union of disjoint Z sets which are represented in the Euclidean point space as non-intersecting Z surfaces which need not be "parallel." Each Z surface is mapped continuously into one surface called the reference surface. The gradient of this reference surface mapping is called the relator which is a function of the Z surface. The consequences of a general relator are then explored. A displacement form which is linear in Z is shown to not be capable of describing rigid body motion in general. The usual Kirchhoff-Love hypotheses are discussed in some detail and then generalized to admit any initial reference surface mapping. Dissert. Abstr.

N70-17916 Texas Univ., Austin.
THE SHORT-WAVELENGTH APPROXIMATION IN GENERAL RELATIVISTIC, KINETIC, PERTURBATION THEORY
Robert Louis Lyle (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-6179

The short wavelength approximation in general relativistic, kinetic, perturbation theory is investigated. A Robertson-Walker universe with zero spatial curvature is perturbed to first order in the context of self consistent kinetic theory. After the general structure of the equations is elucidated, the solutions are assumed to change rapidly compared to the cosmological background and are treated by the method of Jeans as well as by a second, asymptotic perturbation. It is shown that the wave-particle interaction is a higher order effect than that of the cosmological expansion, but that the classical Jeans method omits the latter while including the former. Dissert. Abstr.

N70-17920# Applied Data Research, Inc., New York, N.Y.
THE REPRESENTATION OF ALGORITHMS, VOLUME 2
Final Technical Report
Robert M. Shapiro and Harry Saint Griffiss AFB, N.Y. RADC Sep. 1969 105 p ref
(Contract F30602-69-C-0034)
(AD-697026; CA-6908-2331-Vol-2; RADC-TR-69-313-Vol-2)
Avail: CFSTI CSCL 9/2

The problem of representing mathematical processes is considered in the context of digital computer software and hardware. Author (TAB)

N70-17982# Wisconsin Univ., Madison. Mathematics Research Center.
SPLINE FUNCTIONS AND STOCHASTIC PROCESSES
George S. Kimpldorf and Grace Wahba Aug. 1969 20 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-696322; MRC-TSR-969) Avail: CFSTI CSCL 12/1

The paper explores relationships between certain prediction problems for stochastic processes and the theory of spline functions. Author (TAB)

N70-17969 Texas Univ., Austin.
INTERSYMBOL INTERFERENCE DUE TO REPEATED USE OF A TIME-CONTINUOUS GAUSSIAN CHANNEL
Joseph Thomas Cordaro, Jr. (Ph.D. Thesis) 1968 35 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6131

The effect on error probability of intersymbol interference due to repeated use of a time-continuous Gaussian channel is examined. The model is one in which the output is the sum of a frequency and power constrained input, and a sample function of a Gaussian noise process. Because of memory in the filter, past inputs affect the present output giving rise to interference. It is shown that the interference is an additional input whose reproducing kernel Hilbert space norm is upper bounded by a function that converges to zero with increasing block length. The effect of the interference on the probability of error can be measured in terms of the effect of this norm on the error bound exponent. The exponent of the probability of error upper bound depends on the difference between the norm bound and the error exponent without interference and thus interference is negligible when the block length is large enough. Dissert. Abstr.

N70-17970 Northwestern Univ., Evanston, Ill.
GRAPH THEORETIC VARIABLE-LENGTH CODES
Leonard Saul Bobrow (Ph.D. Thesis) 1968 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $2.00 Order No. 69-6895

A class of D-nary exhaustive prefix codes which are generated by graphs is presented. The structure of a graph is utilized for decoding purposes. The concept of the inclusion property is introduced, and algorithms for the construction of an inclusion code equivalent to any specified exhaustive prefix code are given. It is shown that the inclusion property is a sufficient condition for a code to have an equivalent graph theoretic realization. Such a graph, which will always have less branches than the tree representation of the code, can be found easily. It is demonstrated that exhaustive variable-length inclusion codes are neither anagrammatic nor uniformly composed. Therefore, a necessary and sufficient condition for such codes to be self-synchronizable is g.c.d. (lengths) = 1. Dissert. Abstr.

N70-18031# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
CONVOLUTION OPERATORS IN SPACES OF NUCLEARLY ENTIRE FUNCTIONS ON A BANACH SPACE
Leopoldo Nachbin 1968 11 p refs Submitted for publ. Sponsored by NSF
Its Notas de Fisica, v. 15, no. 8
Avail: CFSTI

A vector subspace on which a convolution operator in a locally convex space does vanish is the closure of its vector subspace generated by the nuclear exponential-polynomials that it contains. The theorem is proved via the Hahn – Banach theorem by two propositions, one of which concerns a characterization of Borel transforms of all the elements in the dual space, and the other refers to a division property between such Borel transforms. R.B.

N70-18040# Harry Diamond Labs., Washington, D.C.
LINEAR VECTOR SPACE THEORY OF UNFOLDING
Nick Karayianis, Clyde A. Morrison, and Donald E. Wortman Jun. 1969 33 p refs
(AD-696480; HDL-TR-1452) Avail: CFSTI CSCL 9/4

The problem of unfolding a spectrum is treated by the methods of linear vector space theory. For a system with a finite number of measurements consisting of the outputs from detectors

with known responses, some part of the unknown spectrum cannot be inferred. One may approximate the unknown spectrum with a finite expansion in terms of some arbitrary set of functions w sub n (E). The relationships between the various solutions obtained by using different sets of w sub n (E) functions are explored, and it is shown that the solution obtained by allowing the w sub n (E) to be the response functions themselves displays some unique and desirable properties. Among these properties is an insensitivity to small errors in the measured outputs from the detectors and in the analytic response functions used to describe the true detector responses. Author (TAB)

N70-18057 Pennsylvania Univ., Philadelphia.
AN EXTENSION OF THE LARGE SIEVE TO ALGEBRAIC NUMBER FIELDS
Robin James Wilson (Ph.D. Thesis) 1968 41 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-5877

Some results on the large sieve are generalized to an algebraic number field K. It is first shown that given any finite set of pairwise nonassociate integers of K and any finite set of nonramifying prime ideals then the elements are well distributed among the residue classes. The corresponding results for characters are derived and used to prove the analogues of the theorems of Davenport - Halberstam and Bombieri on primes in arithmetic progressions. Dissert. Abstr.

N70-18065# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE SOLUTION OF THE HEAT CONDUCTION EQUATION FOR SMALL FOURIER NUMBER
Joseph H. Spurk Sep. 1969 12 p refs
(AD-696469; BRL-1450) Avail: CFSTI CSCL 12/1

The problem of heat conduction in an infinite slab of thickness 2l is solved by parameter perturbation for small values of the Fourier number. Author (TAB)

N70-18070 Washington Univ., Seattle.
SENSITIVITY ANALYSIS ON THE MULTIPLE-ACTION PROBLEM
Herbert Eugene Phillips (Ph.D. Thesis) 1968 246 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 69-7075

Attention is confined to the class of subjective prior distributions which are continuous in nature and Normal in form. First questions concerning the class of simple two-action decision making problems are considered. Attention then turns to the general case, where any number of action alternatives may be considered. Monte Carlo methods are used in order to study the sensitivity of the Bayesian decision rule to the introduction of subjective prior information. The simulation models are manipulated by systematically varying the parameters of each of the data generating functions involved. Sensitivity is measured in terms of the effect that prior information has on the resulting distributions of terminal opportunity losses. A typical decision-making situation is considered: An administrator is faced with a problem of selecting one of a set of mutually exclusive action alternatives. Each action alternative is viewed as a process—a process for producing results. Dissert. Abstr.

N70-18072 University of Southern Calif., Point Mugu.
ON THE ABSOLUTE STABILITY OF NONLINEAR DYNAMIC SYSTEMS
Shahpour Partovi (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-838

Recently the convenient criterion of Popov and its extensions have been developed to examine the absolute stability of a dynamic system with special class of nonlinearities. Each nonlinear element of this system is only a function of a linear combination of the state variables and possibly a function of the independent variable, time. The main purpose of this report is to extend Popov's criterion and establish sufficient conditions for absolute stability of a broader class of nonlinear systems; namely the class with a nonlinear element which is a function of more than one combination of state variables. A system of differential equations containing a single nonlinear element is considered. This nonlinear element is a function of two different linear combinations of state variables. Sufficient conditions for absolute stability of the differential equations are derived. These conditions are similar to the frequency domain stability criterion of Popov. Dissert. Abstr.

N70-18083*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ADAPTIVE RANDOM-SEARCH ALGORITHM FOR IMPLEMENTATION OF THE MAXIMUM PRINCIPLE
Elwood C. Stewart, William P. Kavanaugh, and David H. Brocker Washington Feb. 1970 71 p refs
(NASA-TN-D-5642; A-3134) Avail: CFSTI CSCL 12A

In this paper a feasible method of implementing the maximum principle is given which can be used to generate explicit optimal solutions to high-order nonlinear control problems, either variable or fixed time. The method is based on an adaptive random-search algorithm, and has a number of advantages over other approaches. Example applications are given for which optimum solutions have not been previously obtained; it is demonstrated that striking improvement in performance can be obtained by the use of optimal nonlinear control. Author

N70-18089 Alabama Univ., University.
ON K-COMMUTATIVE MATRICES
James William Steincamp (Ph.D. Thesis) 1968 47 p refs
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6573

The definition of matrix k-commutativity and the use of this concept to obtain generalizations of normal and EPr matrices is considered. Letting K(A) = {B: there exists k such that A is k-commutative with respect to B}, it is shown that the dimension of K(A) equals the sum of the squares of the multiplicities of the eigen-values of A as roots of the characteristic polynomial of A. Moreover, it is shown that if the greatest of the degrees of the elementary divisors of A is v, then the sum of the squares of the number of elementary divisors of degree v corresponding to each distinct eigenvalue is the maximum number of linearly independent matrices with respect to which A is exactly (2v - 1)-commutative. Defining A to be k-normal or k-EPr according as A is k-commutative with respect to its complex conjugate transpose or its Moore - Penrose inverse, it is shown that several theorems usually stated for normal or EPr matrices remain valid, or possess analogous formulations, for these generalizations, and it is shown by necessary and sufficient conditions that a matrix can be k-normal or k-EPr. Dissert. Abstr.

N70-18095 Purdue Univ., Lafayette, Ind.
ON THE BRAUER SPLITTING THEOREM
George Szeto (Ph.D. Thesis) 1968 50 p refs
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-7507

Let R be a commutative ring and G be a finite group of order n, then n is invertible in R if and only if RG is separable. If RG is a separable group algebra, any RG-module is finitely generated projective over RG if and only if it is finitely generated projective over R. The ring R is always assumed to be a commutative ring with identity and RG is assumed to be separate. A generalization of the Brauer Splitting Theorem is proved. The concept of the Schur index of a group algebra to the group ring is also generalized as an application of the above results. Techniques for computing the Schur index in the context of a commutative ring are considered. Dissert. Abstr.

N70-18097# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
OPTIMUM COMBINATION OF CONTROL AND OBSERVATION [SUR LA COMBINAISON OPTIMALE DE LA COMMANDE ET DE L'OBSERVATION]
G. S. Chelementev [1969] 22 p refs In FRENCH and RUSSIAN (LRBA-69-0459) Avail: CFSTI

Solutions are obtained for a problem on the most effective reduction of a control system to a given condition with a specific boundary imposed on the control input and observation conditions of partial phase coordinates. The optimum moment of transfer time from observation to control is determined. The problem resembles a limited minimax analog of a stochastic control problem. Transl. by E.C.

N70-18099 Pittsburgh Univ., Pa.
GENERALIZED LIMITS IN LOCALLY COMPACT sigma-COMPACT TOPOLOGICAL GROUPS
Carole Anne Sloane Izen (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-6409

The concept of generalized limit is extended to a vector space M of functionals (which includes all bounded and all convergent functionals) on any closed noncompact sub-semi-group of a locally compact sigma-compact topological group. The Banach linear extension theorem is used to prove the existence of a linear functional on M satisfying four conditions. Almost convergence and generalized limit are then defined. The generalized limit on M generalizes the limit in the sense that if a function converges, then it is almost convergent to the same limit. This definition of convergence reduces to the ordinary convergence of a sequence and of a double sequence. Necessary and sufficient conditions for almost convergence are given. In particular cases, these conditions are used to prove more useful criteria for almost convergence. The properties of the generalized limit are discussed in detail. Several theorems on convergence of sequences which can be generalized to almost convergence are proven, in particular, a generalization of the dominated convergence theorem and Fatou's Lemma. On the other hand, examples of theorems which hold for convergent sequences and whose analogues fail for almost convergent sequences are also given. Some of the important concepts in the theory of summability are those of regular, conservative, coercive and multiplicative matrices. Almost coercive and almost multiplicative matrices are defined analogously and necessary and sufficient conditions for a matrix to belong to these classes are given. Dissert. Abstr.

N70-18113# Technische Hochschule Stuttgart (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
EIGENVALUES OF LARGE MATRICES
O. E. Broenlund 12 Jun. 1969 55 p refs Presented at the Symp. on Finite Elem. Tech., Stuttgart, Germany 10-12 Jun. 1969 Avail: CFSTI

This paper gives a survey of several methods available to solve a general linear eigenvalue problem, where both matrices are symmetric and at least one is definite. The emphasis of the discussion is put on solution for matrices too large to fit in the central memory of a computer. Author

N70-18114 Texas A and M Univ., College Station.
THE USE OF MONTE CARLO METHODS IN SOME STATISTICAL DISTRIBUTION PROBLEMS
Suharto Soedardjo (Ph.D. Thesis) 1968 88 p refs
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-5152

Two Monte Carlo methods are developed for the solution of some statistical distribution problems for which the exact mathematical solutions in compact form cannot be derived. Specifically, a general theory is derived concerning the use of Monte Carlo to approximate the probability distribution of some statistic, h, in the form of $P[h \leq H]$. In the first procedure shortcuts are introduced in the computer generation of the values, x sub i, of the random sample drawn from the parental distribution with ordinate f(x) and c.d.f. F(x). The technique is one of using an approximation G(x) to the original c.d.f. F(x). In the second procedure the theory is developed for the evaluation of the probability integral of the statistic, h, by using Monte Carlo methods based on the theory of stratified sampling. In this procedure the total variate range of x is split into k equal probability ranges. It is shown that when the number of strata is large and only one sample is drawn per stratum, this procedure becomes equivalent to the evaluation of the distribution of h by using numerical integration methods. Dissert. Abstr.

N70-18133 Oregon Univ., Eugene.
CENTRALIZER RINGS OF INDUCED LINEAR REPRESENTATIONS
Timothy Vaughn Fossum (Ph.D. Thesis) 1968 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-6625

In a paper by C. W. Curtis and the author, character theory was used to obtain information about the centralizer ring of a representation of a finite group G induced from a linear representation of a subgroup H in a splitting field of characteristic zero. This information was applied to obtain a number-theoretic result concerning the degrees of the irreducible constituents of the induced representation. This thesis continues the above investigation in two directions, towards twisted group algebras and modular representations. Dissert. Abstr.

N70-18139 Michigan State Univ., East Lansing.
PROPERTIES OF 3-MANIFOLDS WHICH ADMIT A FREE CYCLIC GROUP ACTION
Jeffrey Lynn Tollefson (Ph.D. Thesis) 1968 54 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-5975

This thesis is a study of the nature of compact 3-manifolds which admit a free action by a finite cyclic group Z sub k of order k. Some interesting results are obtained on manifolds M for which there exist a k-sheeted covering map $p: M \rightarrow M$. A proper Z sub k action is one with the property that a generator of the action is homotopic to the identity. Dissert. Abstr.

N70-18155 Purdue Univ., Lafayette, Ind.
CLASSIFICATION OF EXPERIMENTAL DESIGNS RELATIVE TO POLYNOMIAL SPLINE REGRESSION FUNCTIONS
Donald James Van Arman (Ph.D. Thesis) 1968 57 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-7513

Experimental designs relative to a polynomial spline regression function on [a,b] are considered. Admissibility is defined in terms of the information matrix and show that admissibility is equivalent to certain moment conditions. Using properties of spline functions a theorem for the case of a one knot regression vector is presented. Two particular results are that an admissible design must be subadmissible and that the admissible designs are contained in the class of subadmissible designs with fewer than $(h+1)(n-1)+1$ points of their spectrum in (a,b). A conjecture for the general solution to the problem of classifies admissible designs. Dissert. Abstr.

N70-18167 Pittsburgh Univ., Pa.
ANALYSIS OF JACOBI SUMS OF VARIOUS ORDERS
Yun-Cheng Zee (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-6416

In the complete analysis of the Jacobi sums of order s, a set of primitive Jacobi sums is determined, the arithmetic relations between each primitive Jacobi sum and its equivalent Jacobi sums are found, and the principal ideal generated by R(m,n) and sigma sub s R(m,n) is found. Complete analyses were given for the Jacobi sums of orders 11, 22, 33, 44, 36, 48, 19, 38,

17, 34, 51, 68, 40, 60, 13 and 39. New binary or quaternary quadratic decompositions of p or a multiple of p were found to be associated with Jacobi sums of orders 13, 60, 22 and 39. The elementary relationships between Jacobi sums and the famous Gaussian sum identity of Davenport and Hasse supplied all the arithmetic relations between Jacobi sums except one. Dissert. Abstr.

N70-18158 Texas Christian Univ., Fort Worth.
CERTAIN LOCAL PROPERTIES OF TOPOLOGICAL SPACES
Nazem M. Marrach (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6600

The properties of spaces and some relations which exist among them are presented. Specifically, the following theorems are proven. (1) If a space X is both an L-space and a q-space then X is a k-space. (2) If a space X is a k-countable q-space then X is both an r-space and a k-space. (3) A k-countable q-space is preserved under an open mapping. (4) The product space of two k-countable q-spaces is a k-countable q-space. (5) If X is a pseudo-compact L-space then X is a k-space. (6) If X is a pseudo-compact k-countable space then X is both an r-space and a k-space. Further, we show that the notion of L-space is sufficient to insure the pseudo-compactness of the product of two pseudo-compact spaces. Pseudo-compactness which appeared in the above results has some interaction with these local properties. Dissert. Abstr.

N70-18164 Colorado State Univ., Fort Collins.
PSEUDO INVERSES AND THE HERMITE FORM
Carl Dean Meyer, Jr. (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-5489

The least squares inverse of an m × n complex matrix is defined and developed. The concept of Hermite form is generalized to rectangular matrices and relationships between a matrix A, its Hermite form, and pseudo inverses of A are developed. The Hermite form is used to obtain triangular idempotent right and left identities for an m × n complex matrix A of rank r such that the right identities have every rank between r and n and the left identities have every rank between r and m. Finally, a few new computing methods are presented for obtaining conditional, least squares, and generalized inverses. Dissert. Abstr.

N70-18170 Michigan State Univ., East Lansing.
CPI-PARTITIONS OF FINITE GROUPS
James Welling Richards (Ph.D. Thesis) 1968 246 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 69-5935

Often in the study of mathematical systems, information about a given system can be obtained from presupposed properties other than the intrinsic ones. More specifically, in the study of finite groups with which we shall be concerned-information about a given abstract group sometimes can be extracted if one presumes certain conditions on its lattice structure. Reinhold Baer has studied finite groups which admit a partition, that is, a family sigma of subgroups of G which cover G so that distinct numbers have trivial intersection. The sue of any but the most gentle priors seemed too risky a proposition ever to be worthwhile in parctice. However, in no case considered did there appear to exist a consistent relationship between the quality of the prior information and the quality of the results. Based upon the experimental results, and the associated conclusions, a specific recommendation is made: that subjectivity in statistics be put aside until more is known about the behavioral characteristics of subjectiviats. Dissert. Abstr.

N70-18173 Minnesota Univ., Minneapolis.
INTEGRAL REPRESENTATIONS OF CERTAIN LINEAR OPERATORS
Gerald William Johnson (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-6821

Representations are given of certain continuous linear operators whose domain is some space of continuous functions; the operators are represented by means of additive set functions and the correspondence between operator and set function is given by integration. Some of the conditions mentioned involve the magnitude of the velocity vector, and so, relationships between it and the geometry are observed. Thus, the geometry and the dynamics are related. Concerning the dynamical equations and their solutions, the following was done. A system of equations equivalent to the dynamical equations is obtained using two families of stream surfaces and the family of constant pressure surfaces as coordinate surfaces. From this reformulated system of equations, two classes of plane flows are found, and a single ordinary differential equation is obtained whose solution leads to a class of three dimensional flows. Dissert. Abstr.

N70-18174 Michigan State Univ., East Lansing.
A CHARACTERIZATION OF CERTAIN CLOSED 3-MANIFOLDS
Gerhard Walter Knutson (Ph.D. Thesis) 1968 61 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-5897

Let M be a closed connected bombinatorial 3-manifold. A compact subcomplex A of M is a residual set of M if M is the disjoint union A ∪ U of an open 3-cell U dense in M and a non-separating continuum dimension less than 3. The singular set of A, S(A), is the set of points of A that do not have an open 1- or 2-dimensional euclidean neighborhood in A. The relationship between A and M is examined. In particular it is shown that if A does not contain a wild arc then A is picked so that S(A) is a point. Then the following theorem is subsequently proven: M has a residual set that contains no wild arc if and only if M is the connected sum of closed 3-manifolds. It is also shown that A may be picked so that A - S(A) is the disjoint union of open arcs and the interiors of compact 2-manifolds with connected boundaries. Under this assumption, if S(A) is a simple closed curve, M is the connected sum of closed 3-manifolds. Dissert. Abstr.

N70-18176 Texas Univ., Austin.
ON THE PERRON INTEGRAL AND SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS
Manoug Nishan Manougian (Ph.D. Thesis) 1968 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-6180

Some of the properties of the Perron integral are established in the space of two dimensions and the existence and uniqueness of solutions to partial differential equations by use of the Perron integral are investigated. A theorem is proved concerning the limit of a sequence of Perron integrals. Given a sequence of Perron integrable functions, a necessary and sufficient condition is stated under which the limit of the integrals is the integral of the limit function. This theorem and Picard's method of successive approximations are used to establish existence and uniqueness of solutions to the following partial differential equations. Dissert. Abstr.

N70-18178 Texas Christian Univ., Fort Worth.
GENERALIZED SEMIRINGS OF QUOTIENTS
James Roberts Mosher (Ph.D. Thesis) 1968 69 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-6604

A semiring is a non-empty set on which two associative binary operations, called addition and multiplication, are defined such that the multiplication distributes over the addition from the left and from the right. In this paper all semirings considered will be assumed to have commutative operations as well as a zero. The semi-subtractive property for semirings is defined. Three aspects of ideal theory are investigated for semirings that have the semi-subtractive property. The concept of an irreducible ideal is generalized to semirings. It is shown that in a certain class of semirings every k-ideal is a finite intersection of primary ideals. The

concept of a quotient semiring of a semiring by a sub-semigroup of the semiring is developed for the class of semirings with the semi-subtractive property. Extension of ideals to the quotient semiring is defined, and also contraction of ideals from the quotient structure. Of particular interest is the behavior of prime and primary ideals under extension. Finally, the theory of the quotient structure provides a means of characterizing primary ideals in this class of semirings. The concepts of maximal prime divisors, minimal prime divisors, and prime divisors are extended to semirings. Dissert. Abstr.

N70-18216 Rensselaer Polytechnic Inst., Troy, N.Y.
ON THE DUALS OF NON-HAMILTONIAN MAPS
Paul Arthur McGloin (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-6469

After a brief review of the history of the Four Color Theorem, the terms to be used are defined, then the Reductions of Birkhoff are rephrased (including the proofs) in the dual form. It is then pointed out that the classes of networks to which the four-color theorem has been reduced from a nested sequence. These classifications are determined basically from the Reductions of Birkhoff. The cyclability of these classes of networks is then considered, and a question which had been raised concerning the cyclability of networks in one of these classes is answered through the construction of a non-cyclable Birkhoff network. The same question is then considered for the next smaller class of networks (the Simple Birkhoff Networks) and a description is given of the (as yet unsuccessful) attempts to answer the question for this class. A conjecture that there are non-cyclable Simple Birkhoff Networks and some remarks concerning the necessity of extending the sequence of classes of networks is mentioned. Dissert. Abstr.

N70-18217 Texas A&M Univ., College Station.
OPTIMAL PARAMETER ESTIMATION IN MULTIPLE SAMPLE PROBLEMS
Bobby Ray Waldron (Ph.D. Thesis) 1968 61 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-5161

A general estimation technique is developed for combining information in order to obtain optimal estimates of parameters by utilizing multiple independent samples, each of which may contain information about some or all of the parameters. In addition, a sequential technique is given for sequentially computing the Cramer – Rao lower bounds on the variances of the estimates. The above technique is shown to be a sequential method for solving the maximum likelihood equations for certain classes of estimation problems. The procedure is also shown to have the optimal properties of consistency, and asymptotic efficiency under very general conditions regardless of the basic underlying distribution. Dissert. Abstr.

N70-18218 Alabama Univ., University.
DYNAMICAL POLYSYSTEMS AS GENERALIZATIONS OF CONTROL SYSTEMS
Judson Allison Lovingood (Ph.D. Thesis) 1968 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-6552

Similarities and differences of generalized control systems and dynamical polysystems are investigated, and several results are obtained which establish connections between the two. One of the main results is that, while neither of the above mentioned systems is a special case of the other, a dynamical polysystem with an additional condition imposed satisfies the axioms of a generalized control system. This result is obtained with weaker assumptions on the space than is required for the axioms of a generalized control system to make sense. The dynamical polysystem formulation uses a topological space which is analogous to the collection of admissible control functions in a control process. Assuming the space to be sequentially compact results in a special case of a dynamical polysystem. The main emphasis is on dynamical polysystems of this special type. Dissert. Abstr.

N70-18222 Southern Illinois Univ., Carbondale.
GENERAL SELF-ADJOINT DIFFERENTIAL EQUATIONS
M. S. Thrivikraman Namboodiri (Ph.D. Thesis) 1968 55 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6293

Some properties of the zeros of solutions of ordinary, self-adjoint differential equations of arbitrary even order, are established in this paper. Of particular concern is the existence of a non-trivial solution of the equation which satisfies a set of boundary conditions. The boundary conditions characterize conjugate points and focal points. The conditions for the existence of these points, and their relative ordering if they exist, are established by considering a matrix system. Two sufficient conditions, one for the operator to be oscillatory and another to be non-oscillatory, are given by methods unrelated to the matrix system. Finally, the concepts of the operator L being oscillatory and of the existence of conjugate points are shown to be equivalent. Dissert. Abstr.

N70-18223 Pittsburgh Univ., Pa.
SOME PROPERTIES OF TRANSFORMATIONS OF DOUBLE SEQUENCES
Edward James Neuendorf (Ph.D. Thesis) 1968 42 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6401

During the past half-century the properties of matrix transformations of simple sequences have been investigated very thoroughly. This paper concerns itself with results that can be obtained by considering some of the analogous situations that arise in working with double sequences or series. Given a sequence of real or complex numbers and a set of real or complex numbers a new sequence is defined by a relation. The sequence is called a transform and there is a matrix of the transformation. Definitions are stated for a matrix to be conservative, regular, coercive or multiplicative. Dissert. Abstr.

N70-18231 Oregon Univ., Eugene.
M-GROUPS AND THE SUPERSOLVABLE RESIDUAL
Gary Michael Seitz (Ph.D. Thesis) 1968 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-6666

The preliminaries are developed, and results from the theory of formations are stated. Also a few character theory results are proved for M-groups that sharpen known results holding for more general classes of groups. The connection between M-groups and solvable groups is discussed. It is shown that there is a bound on the derived length of an M-group in terms of its characters. Then Dade's theorem is generalized to show that a solvable group can be embedded in an M-group having the same derived length. A theorem is proved giving a sufficient condition for a solvable group to be an M-group. This theorem is proved quite simply and has Dornhoff's theorem as an immediate consequence. The special cases are presented. Dissert. Abstr.

N70-18240 Oregon Univ., Eugene.
PARTIAL ORDERS AND THE FIXED POINT PROPERTY FOR HEREDITARILY UNICOHERENT CONTINUA
Lee Knight Mohler (Ph.D. Thesis) 1968 58 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6650

The thesis is concerned with two problems. The first has to do with the fixed point property for continua which are hereditarily divisible by points and the second concerns the implications of the continuity of a certain partial order on a hereditarily unicoherent continuum. Three fixed point theorems are proved. The first is a generalization of the theorem of Young which says that if an arcwise connected metric space has the property that the union of any nest of arcs in the space is contained in an

arc in the space, then the space has the fixed point property. This theorem is generalized to the non-metric setting with arc being replaced by topological chain. The second, and main, fixed point theorem states that if H is a hereditarily unicoherent continuum and tau(H) is not equal to infinity, then H is hereditarily divisible by points and H has the fixed point property. The third fixed point theorem states that if a continuum is hereditarily divisible by points and topologically chained, then it has the fixed point property. Dissert. Abstr.

N70-18245*# California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
NOTE ON THE CONVERGENCE OF CONJUGATE DIRECTION METHODS [NOTE SUR LA CONVERGENCE DE METHODES DE DIRECTIONS CONJUGUEES]
E. Polak and G. Ribiere (Inst. Blaise Pascal) 1969 15 p In FRENCH
(Grant NGL-05-003-016)
(NASA-CR-107803) CSCL 12A

The convergence of several algorithms designed to find a minimum function is demonstrated. Matrix methods are used in developing a general theorem of convergence which is applied to conjugate direction methods. These methods are compared with the Newton method and are found not to vary from that original method. Also previously published methods are modified and compared with the method presented. Transl. by J.M.C.

N70-18248# Queens Univ., Kingston (Ontario). Dept. of Mathematics.
SERIES EXPANSIONS FOR RANDOM PROCESSES
L L Campbell May 1968 43 p refs
(Contract CD-DRB-713000)
(RR-68-3) Avail: CFSTI

A general expansion theorem and corresponding Parseval equation are determined for a series expansion of G(t) plus X(t) where X(t) is a random process and G(t) is a function in a reproducing kernel Hilbert space (RKHS) which is related to the spectral density function of X(t). Special cases of the theorem are considered and the connection between inner products in the RKHS and integrals is examined. It is shown that the representation of an inner product as an integral depends on the solution of an integral equation which arises in detection theory. The application of these series to problems of detection and information theory is examined. D.L.G.

N70-18250# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE PERTURBED VOLTERRA INTEGRAL EQUATION
Technical Summary Report
Aaron Strauss May 1969 21 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-696325; MRC-TSR-981) Avail: CFSTI CSCL 12/1

For the Volterra integral equation x(t) = f(t) - the integral from 0 to t of (a(t,s)(x(s) + g(s,x(s))) ds), if the resolvent kernel of a(t,s) is sufficiently well-behaved, and if the absolute value of g(t,s) approaches 0 as t approaches infinity in some sense, then the absolute value of (x(t) - y(t)) approaches 0 as t approaches infinity, where y(t) is the solution of y(t) = f(t) - the integral from 0 to t of (a(t,s) y(s) ds). Author (TAB)

N70-18255 Massachusetts Univ., Amherst.
THE APPROXIMATION OF TOPOLOGIES IN FUNCTIONAL ANALYSIS
Forrest Raymond Miller, Jr. (Ph.D. Thesis) 1968 63 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-5445

Results are obtained for a topology which can be approximated by a circled admissible convergence structure. This is applied to vector spaces and their algebraic duals. A convergence structure is placed, on the completion of a locally convex space, such that the closure is the quasicompletion. A Cauchy structure which agrees with the Bourbaki completion if the Cauchy structure is induced by a Bourbaki uniform structure is constructed. Partial completions are obtained for locally convex spaces. Dissert. Abstr.

N70-18260 Texas Technological Coll., Lubbock.
TOPOLOGICAL CHARACTERIZATION OF AN INNER PRODUCT SPACE
Howard Barrow Lambert (Ph.D. Thesis) 1968 25 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6444

The significant purpose of this research is to give necessary and sufficient conditions on a topological linear space X, in order for it to be possible to define an inner product on X. The emphasis is on the topological structure of the space rather than on some particular norm that might be defined on the space. A brief history is given of the work done in the area of topological characteristics of a normable space and of the research done in the relationships between a norm defined on a space and an inner product defined on the same space. The topological characteristics of an inner product space are given. The principal conclusions of this chapter are contained in the following three theorems. Dissert. Abstr.

N70-18258 Missouri Univ., Kansas City.
DENDRITIC CONTINUA
Gary Glenn Miller (Ph.D. Thesis) 1968 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-7228

A structure theory for dendritic continua is obtained. It is proven that every pair of points in a Hausdorff tree is separated by a third point provided the tree has at least three points. Thus if a tree endowed with the intrinsic topology is a continuum, it is a dendritic continuum. Moreover, if X is a dendritic continuum, then X is a tree relative to its separation order and X has the intrinsic topology. Dendritic continua is characterized solely in terms of order theoretic notions: X is a dendritic continuum if and only if X is a tree with a lower bound, each of its maximal chains is both order complete and order dense in itself, and X has the intrinsic topology. Every tree is shown to be completed to form a dendritic continuum. Dissert. Abstr.

N70-18268 Pittsburgh Univ., Pa.
ON CERTAIN GENERALIZED TAYLOR TRANSFORMS
Stanley David Luke (Ph.D. Thesis) 1968 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-6400

Two special classes of summability matrices related to Laguerre polynomials are studied. One class is a matrix which contains no zeros. Regularity conditions, matrix-transform continuation of a geometric series, comparisons with the Abel and Borel methods of summability, conditions for the omission and adjunction of elements by the two classes, and the forms taken by the summability matrix methods when applied to series instead of sequences are provided by the main theorems. Dissert. Abstr.

N70-18285 Michigan State Univ., East Lansing.
THE HYPERQUASICENTER OF A FINITE GROUP
Narayan Prasad Mukherjee (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-5920

The quasicentral element of a group is a generalization of the idea of an element in the center. Quasicentral elements which generate subgroups are defined. Characteristics of quasicenters such as structure, relation to other subgroups, and relation to the Kern group or the hypercenter are summarized. Whether quasicenter characteristics can be generalized to the hyperquasicenter is considered. New characterizations of both the hypercenter and the hyperquasicenter are provided. Dissert. Abstr.

N70-18304# Joint Publications Research Service, Washington, D.C.
FINITELY CONVERGING ALGORITHMS FOR THE SOLUTION OF DENUMERABLE SYSTEMS OF INEQUALITIES AND THEIR APPLICATION IN PROBLEMS OF ADAPTIVE SYSTEM SYNTHESIS
V. A. Yakubovich 11 Feb. 1970 9 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 189, no. 3, 1969 p 495–498
(JPRS-49652) Avail: CFSTI

Let x be the vector of the Euclidian space R. For the given x0 is a member of G in R the sequence xT is a member of G in R is defined by a relation which must be constructed according to the indicated requirements. It is proposed that there is an algorithm A which for any t = 0, 1, 2, ... with respect to the vectors x0, ..., xT generates the function fT(x) and the number alpha sub t > 0. The given algorithm is called a finitely converging algorithm of a given denumerable system of inequalities and it provides the solution of an infinite number of inequalities not shown in advance in a finite number of steps. The algorithms are used to solve problems of synthesis of adaptive systems. R.B.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-16907 National Lending Library for Science and Technology, Boston Spa (England).
THUNDERSTORM ACTIVITY IN THE NORTHERN HALF OF THE ATLANTIC OCEAN ACCORDING TO OBSERVATIONS IN 1966
B. K. In'Kov 20 Jul. 1969 11 p refs Transl. into ENGLISH from Glav. Geof. Obs., T. vyp. (Russia), no. 225, 1968 p 59–64
(NLL-M-7790-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Monthly charts of the relative distribution of thunder storm activity in the northern half of the Atlantic Ocean (from the Arctic to the equator) are drawn, using one-point observations of atmospherics, made systematically at Voeikovo (near Leningrad) in 1966. Thunderstorm activity was greater in the western part of the ocean than in the eastern part throughout the year, which agrees with long-term meteorological observations, although these refer mainly to coastal regions. The size and position of the most active regions change during the year. The characteristic features of the annual variation of thunderstorm activity, which changes from place to place, are shown clearly enough by observations of atmospherics and are confirmed by the data on the mean number of thunderstorm days for two sharply different points, which are given as an example. Author

N70-16914 National Lending Library for Science and Technology, Boston Spa (England).
A TEST OF THE ISALLOHYPSE METHOD FOR FORECASTING RAIN IN THE ZAILIJSKIJ ALATAU MOUNTAINS
M. H. Bajdal [1969] 13 p ref Transl. into ENGLISH from ALMA-ATA, Kazahskij Nauch.-Issled. Gidromet. Inst., T. vyp. (Russia), no. 29, 1967 p 36–41 In RUSSIAN and ENGLISH
(NLL-M-7755-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The proposed isallohypse method is applied to the forecasting of precipitation in mountain regions, considering changes in dew point deficit simultaneously with changes in thickness. The correctness of the experimental forecasts were analized using the proposed method. Author

N70-16919 National Lending Library for Science and Technology, Boston Spa (England).
SOME INTERRELATIONSHIPS OF LARGE-SCALE CIRCULATION PATTERNS IN THE TROPOSPHERE AND STRATOSPHERE
H. Wada 25 Sep. 1969 31 p refs Transl. into ENGLISH from J. Meteorol. Res. 20 (Tokyo), 1968 p 109–120
(NLL-M-7784-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 photocopy coupons

For the purpose of improving long range weather forecasting, some statistical and synoptic facts about the interrelationships of large scale circulation patterns in the troposphere and stratosphere during the winter season are presented. The basic stratospheric data used are the series of charts published by the institute for meteorology and geophysics. Large scale pattern in the troposphere has a close relation with the changes of the polar night vortex and Aleution high in the stratosphere and the prediction of their behaviors is very important from a synoptic viewpoint for the improvement of long range forecasting. The correlation coefficients between 5 day mean 500 mb and 30 mb heights for the northern hemisphere are calculated for the winters of 1962 to 1963 and 1963 to 1964. Author

N70-16922 National Lending Library for Science and Technology, Boston Spa (England).
A METHOD FOR FORECASTING THE AMOUNT OF SHOWER PRECIPITATION IN THE MOUNTAINOUS REGIONS OF SE KAZATHSTAN AND ADJACENT REGIONS FOR 24–36 HOURS
R. S. Golubov [1969] 30 p refs Transl. into ENGLISH from ALMA-ATA, Kazahskij Nauk. Issled. Gidrometeorologicheskij Inst. (Russia), no. 29, 1967 p 3–18
(NLL-M-7744-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The author gives a technique for the numerical forecasting of precipitation in the region of the foothills of the TIEN SHAN which takes account of advective and adiabatic changes in temperature and the modification of air masses. Author

N70-16945 National Lending Library for Science and Technology, Boston Spa (England).
ON THE PROBLEM OF THE CIRCULATION CONDITIONS IN THE MOUNTAIN VALLEY OF MEDEO IN THE WARM PART OF THE YEAR
L. V. Budashkina [1969] 40 p refs Transl. into ENGLISH from Tr. Kazakhsk. Nauchn.-Issled. Gidrometeorol. Inst. (Leningrad), no. 29, 1967 p 59–78
(NLL-M-7745-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

Mountain and valley 24-hour circulation and atmospheric relationships are considered. The interchanging of valley and mountain breezes was observed from balloon ascents designed to measure the direction and speed of the wind aloft. Other balloon flights were launched to measure winds in the surface layer. Atmospheric circulation conditions up and down the valley from directions with transverse components were determined by using the projection of wind vectors on the axis of the valley for all observations at surface and aloft. J.M.C.

N70-16948# National Environmental Satellite Center, Washington, D.C.
ON THE STATISTICAL RELATION BETWEEN GEOPOTENTIAL HEIGHT AND TEMPERATURE-PRESSURE PROFILES
W. L. Smith and S. Fritz Nov. 1969 17 p refs Presented at the 49th Ann. Meeting of the Am. Meteorol. Soc., New York, N.Y., 20–23 Jan. 1969
(ESSA-NESCTM-18) Avail: CFSTI

Statistical relations between geopotential height and temperature are derived. An attempt is made to determine the

accuracy to which geopotential height might be statistically specified from temperature profiles similar to those soon to be derived from satellite radiation measurements. The results indicate that useful statistical estimates of geopotential height can be obtained under most satellite observing situations. The standard error of geopotential height, during situations when a base condition such as surface pressure cannot be specified, is shown to be about 30 meters. The most severe errors, standard errors as large as 100 meters, will arise for high cloud observing conditions when the geopotential height profiles must be specified solely on the basis of observed stratospheric temperature distributions. For middle cloud conditions, geopotential height profiles can be specified with an RMS accuracy between 20 and 50 meters depending upon season and whether or not the surface conditions, pressure, and temperature are known.
Author

N70-16953# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 218 10 Dec. 1969 p 6–21 refs (See N70-16951 06-13)
Avail: CFSTI

Abstracted data are presented on meteorological measurements and studies. The climates of the Soviet far east, and of Omskaya and Tyumenskaya Oblasts are briefly discussed. Information is given on radar meteorology, weather forecasting, and satellite observations. Humidity measurements, the effect of humidity stratification in the near sea layer, and the relation between humidity fluctuations and moisture fluxes are described. Ozone distribution, liquid water content in clouds, cloud heights, and liquid precipitation are mentioned. Vertical air movements, the accuracy of wind observations, and radio wave propagation are covered. Radiation transfer, and the effects of atmospheric long-wave radiation on free convection in the troposphere are also described.
N.E.N.

N70-16983# Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
STRONG WIND AND VERTICAL WIND SHEAR ABOVE 30 km
Arthur J. Kantor Aug. 1969 20 p refs
(AD-696598; AFCRL-69-0346; ERP-303) Avail: CFSTI CSCL 4/2

Strong wind and vertical wind shear must be considered for design and operation of vehicles that will either operate in or penetrate the upper stratosphere and mesosphere. Global extremes of these atmosphere parameters are estimated in this report for altitudes above 30 km. For the Northern Hemisphere estimated 90, 95, and 99 % winds, related to the windiest months and locations, are provided for altitudes between 30 and 80 km. Speed increases up to about 55 km and appears to decrease thereafter up to at least 75 or 80 km in November, December, and January. The 99 % winds can be expected to approach 215 mps near 55 km at certain locations between latitudes 35 and 60 N. For the Southern Hemisphere 90, 95, and 99 % winds are provided for altitudes between 30 and 80 km. The 99 % winds reach roughly 200 mps near 55 km. Since estimates for the Southern Hemisphere are not necessarily representative of either the windiest month or location, results are uncertain and speeds probably will be somewhat larger than indicated. For the same percentiles, 1-km thick vertical wind shears have been estimated for altitudes between 30 and 70 km. Shears generally increase, and maximum values tend to move equatorward with altitude.
Author (TAB)

N70-16989 National Lending Library for Science and Technology, Boston Spa (England).
EXPLANATION WITH REGARDS TO THE METHOD OF COUNTING IN MONTHLY METEOROLOGICAL RETURNS NUMBER OF DAYS IN RELATION TO THE AMOUNT AND KIND OF PRECIPITATION
F. Jeniszewski 25 Sep. 1969 9 p Transl. into ENGLISH from Met. Gazeta Obs. PIHM (Warsaw), v. 21, no. 6, 1968 p 10–12
(NLL-M-7780-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The method of recording meteorological precipitation data for monthly reports is clarified. Reports contain the number of days in relation to the amount and kind of precipitation. Mistakes in recording returns apparently stem from confusion on the amounts and kinds of precipitation. Observers were incorrectly adding the days of 0.0 mm precipitation to the total number of days of precipitation depending upon the kind. Tables used in the reports and correct methods for summation are included.
D.L.G.

N70-16994# Army Electronics Command, Fort Monmouth, N.J.
MEASURED TEMPERATURES AND HUMIDITIES INSIDE CLOUDS, FLAGSTAFF, ARIZONA-1966
Albert R. Tebo Sep. 1969 47 p refs
(AD-697112; ECOM-3174; OSD-1366) Avail: CFSTI CSCL 4/2

Temperatures and humidities were measured in aircraft flights in July 1966 at Flagstaff, Arizona. Because of its rapid response and freedom from external influences, an Infrared Atmospheric Thermometer, sensitive to the 15-micrometer wavelength band, was used to provide reliable temperature measurements.
Author (TAB)

N70-17006# Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab.
CLOUD SEEDING EXPERIMENT: Tasmania, 1965–1968 Annual Report
E. J. Smith and E. E. Adderley Jan. 1969 200 p
(RPR-168) Avail: CFSTI

Experiments are being conducted to determine the amount by which seeding clouds with silver iodide smoke released from an aircraft can increase precipitation in a hydroelectric catchment area. The seeding takes place during alternate years according to a randomized time pattern. Clouds are considered suitable for seeding if their tops consist of supercooled water drops at −10 deg C or colder for cumulus clouds, and −5 deg C for stratiform clouds; if they are dense, durable, and compact; and if they have a lifetime exceeding 30 minutes. Rainfall measurement methods are described. Figures depict cloud and wind conditions, target and control rainfall, seasonal variations, and variations with time. Rainfall totals are tabulated for seeded and unseeded periods. Although the data will not be analyzed until the completion of the experiment, the rainfall figures were found to be consistent, with seeding having increased the rainfall to a smaller extent than in 1964.
M.G.J.

N70-17007# Weather Wing (3rd), Offutt AFB, Nebr. Aerospace Sciences.
FORECASTING MINIMUM CLOUDINESS AT DA NANG RVN, HANOI NVN, AND VINH NVN, DURING THE EARLY SW MONSOON SEASON USING UPPER LEVEL NORTHERN HEMISPHERE COMPOSITE MAPS Technical Note
Hugh E. Hanna, Jr. Sep. 1969 37 p refs
(AD-695039; WW-TN-69-5) Avail: CFSTI CSCL 4/2

Composite antecedent upper level charts for 1000, 700 and 300mb are displayed for selected stations in South East Asia. Composite charts precede minimum total cloudiness. Features in the charts which deviate from the monthly mean charts are explained and possible operational uses for the charts are suggested.
Author (TAB)

N70-17040# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
RECURRENCE STATISTICS FOR CERTAIN CLOUD-COVER CATEGORIES
Cyrus R. Mc Allister 28 Oct. 1969 30 p
(Contract F04701-69-C-0066)
(AD-697028; TOR-0066(6520-05)-4) Avail: CFSTI CSCL 4/2

Values of the parameters associated with the kernel of an approximating function developed to estimate conditional probabilities of recurrence are compared across two similarly derived

samples of cloud-amount data. The results tend to suggest the existence of an invariance property related with the parameters with respect to arbitrary categories of cloud-cover amounts.
Author (TAB)

N70-17053# Secretariat General a l'Aviation Civile, Paris (France).
CONTRIBUTIONS TO THE STUDY OF CLIMATE OF VELAY AND HAUT-VIVARAIS [CONTRIBUTION A L'ETUDE DU CLIMAT DU VELAY ET DU HAUT-VIVARAIS]
P. Paul Sep. 1969 110 p refs In FRENCH *Its* Monographies de la Meteorol. Nationale No. 69
Avail: CFSTI

A climatological investigation to determine types of weather in the Velay and Haut-Vivarais regions is presented. Altitude, temperature, weather regimes, and other factors that influence climate are considered. Annual and seasonal weather distributions are tabulated. Favorable weather and climatic rhythms are recorded and assessed monthly. Photographs and meteorological charts are included.
Transl. by J.M.C.

N70-17059# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENT IN WRITING A PROGRAM FOR PROCESSING THE RESULTS OF TEMPERATURE AND WIND SOUNDINGS IN A DIGITAL COMPUTER
D. V. Prashko et al 27 Mar. 1969 13 p refs Transl. into ENGLISH from Tsentralnaya Aerol. Observ. Trudy (USSR), v. 74, 1966 p 71–74
(AD-696612; FTD-MT-24-436-68) Avail: CFSTI CSCL 4/2

At aerological network stations, the initial data (temperature and wind) obtained with radiosondes are manually processed. Since the analytical algorithms vary little over long periods of time and can be rigorously described mathematically, this manual work can be completely automated. Such a program, written in Algol-60 language is described.
TAB

N70-17061# Air Weather Service, Scott AFB, Ill.
AN INTRODUCTION TO WEATHER MODIFICATION
Herbert S. Appleman Sep. 1969 40 p refs Revised
(AD-696619; AWS-TR-177-Rev) Avail: CFSTI CSCL 4/2

Weather modification techniques are explained and Air Weather Service activities in cloud-seeding and fog-dissipation experiments are discussed.
Author (TAB)

N70-17093# Atmospheric Research and Development Corp., St. Louis, Mo.
THE RATE OF GROWTH OF TALL THUNDERSTORMS Final Report, Sep. 1967 – Aug. 1969
Howard H. Hanks, Jr. and Michael J. Long Sep. 1969 44 p refs
(Contract F19628-68-C-0013)
(AD-696685; AFCRL-69-0388) Avail: CFSTI CSCL 4/2

Growth rates of thunderstorms which reach at least 50,000 feet have been summarized for 15 April 1962 - 15 September 1968 for nine cities in the United States. Hourly increment were most used. A shorter time increment of 15-20 minutes was used to determine growth rates at St. Louis, Mo., using a 5.5 cm aircraft-type radar. The relationship between shear and growth rates was also tested. A computer program for estimating tropopause penetrations by large thunderstorms was modified. Results indicate that growth rates obtained are a function of the time increment used. Most tall thunderstorms appeared to change their growth rates significantly during second hour. Shear and stability were not significantly related to thunderstorm growths. The modification of the computer program appears to improve the estimate of the thunderstorm tops.
Author (TAB)

N70-17139# Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 96, NO. 2: DAILY AND MONTHLY NORTHERN HEMISPHERE 10-MILLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1968. PART 2: APRIL – JUNE Quarterly Technical Status Report
Dietrich Just, Barbara Kriester, Karin Labitzke, Renate Lenschow, Karin Petzoldt 1969 114 p
(Contract DAJA37-68-C-1104)
(AD-693288; QTSR-2-Pt-2) Avail: CFSTI CSCL 4/2

The reports are published quarterly and present 10 mb maps, day by day, throughout 1951 to present. Height and temperature data are plotted on each chart and appropriate contours are drawn. A discussion of the stratospheric circulation for each quarter is included. Each volume also contains mean monthly maps and charts of changes in the means from month to month, for the appropriate months.
Author (TAB)

N70-17165# Environmental Technical Applications Center (Air Force), Washington, D.C.
APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ANALYSIS AND FORECASTING
Ralph K. Anderson, Jerome P. Ashman, Fred Bittner, Golden R. Farr, and Edward W. Ferguson Jun. 1969 229 p refs
(AD-697033; AWS-TR-212) Avail: CFSTI CSCL 4/2

The report furnishes guidance in the interpretation of satellite cloud photographs and presents relationships between the satellite data and meteorological elements and parameters. The material is arranged and presented so that the reader has a quick and easy reference of satellite data to weather analysis and forecasting. A satellite cloud atlas and glossary is included to assist in the identification of cloud types and to define certain applicable terms.
Author (TAB)

N70-17236# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
VARIATIONS IN THE ABSORPTION SPECTRA OF ATMOSPHERIC DUST
G. B. Hoidale, A. J. Blanco, N. L. Johnson, and R. V. Doorey Oct. 1969 36 p refs
(AD-697108; ECOM-5274) Avail: CFSTI CSCL 4/2

Six impactor and 99 membrane filter samples of atmospheric dust were collected atop a mountain in south central New Mexico during April and May 1968. Qualitative analysis of these samples by infrared absorption spectroscopy in the 4000 to 250/cm wavenumber (2.5 to 40 micron wavelength) range revealed that the positions and relative intensities of the absorption bands were dependent on the size fraction of the dust and on the time the sample was taken. Within the 1250 to 770/cm (8 to 13 micron) atmospheric window, the micron-sized (giant) particles exhibited a peak absorption at 1027/cm (9.7 micron), whereas the submicron (large) particles had their peak absorption at 1108/cm (9.0 micron). These two absorption bands are induced, respectively, by silicate clays and by ammonium sulfate. A temporal variation was observed in the ratio of the intensities of the 1027/cm (9.7 micron) silicate and the 1425/cm (7.0 micron) carbonate absorption bands of the giant particles. This ratio was high during the early morning, at times of convective activity and precipitation and at times of cold frontal passage from the east; it was low during the afternoon and at times of convective inactivity and no precipitation. The low ratio dust is attributed to advection of fresh soil particles from the exchange layer over the adjacent basin and mountains and the high ratio dust to advection of fresh soil particles from the Great Plains and aged soil particles from the overlying free atmosphere.
Author (TAB)

N70-17274# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 29: SYRACUSE, NEW YORK CLARENCE E. HANCOCK AIRPORT
Jun. 1969 29 p refs
(FA-67-WAI-129)
(SRDS-RD-69-22-Vol-39) Avail: Issuing Activity

Tabulated data from January 1956 through December 1965 are presented for Hancock airport, Syracuse, New York. Ceiling

visibility, wind, and weather information are grouped by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N70-17277# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 23: MILWAUKEE, WISCONSIN, GENERAL MITCHELL FIELD Final Report
Jun. 1969 32 p
(FA-67-WAI-129)
(AD-694540; SRDS-RD-69-22-Vol-23) Avail: CFSTI CSCL 17/7

The report contains climatological data for General Mitchell Field, Milwaukee, Wisconsin. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation at General Mitchell Field, Milwaukee, Wisconsin. Author (TAB)

N70-17303# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 32: PITTSBURGH, PENNSYLVANIA, GREATER PITTSBURGH INTERNATIONAL AIRPORT Final Report
Jun. 1969 32 p
(FA-67-WAI-129)
(SRDS-RD-69-22-Vol-32) Avail: CFSTI CSCL 1/5

The report contains climatological data for the Greater Pittsburgh International Airport, Pittsburgh, Penn. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation at the Greater Pittsburgh International Airport, Pittsburgh, Penn. Author (TAB)

N70-17309# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 36: SALT LAKE CITY, UTAH MUNICIPAL AIRPORT NO. 1
Jun. 1969 32 p
(Contract FA-67-WAI-129)
(ESSA-SRDS-RD-69-22-Vol-36) Avail: CFSTI

Tabulated data covering the period from 1 January 1956 to 31 December 1965 are presented for the Municipal Airport, Salt Lake City, Utah. Ceiling, visibility, wind and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N70-17323# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
AN OPERATIONAL METHOD FOR OBJECTIVELY FORECASTING PROBABILITY OF PRECIPITATION
Harry R. Glahn and Dale A. Lowry Oct. 1969 25 p refs
(ESSA-TM-WBTM-TDL-27) Avail: CFSTI

An operational method for objectively producing forecasts of probability of precipitation is discussed. The screening regression technique is used to relate precipitation observations to variables forecast by two existing numerical models, the TDL subsynoptic advection model (SAM) and the NMC primitive equation (PE) model. Verification figures for a 1 year period are presented for the eastern United States. These figures indicate that the objective forecasts were slightly more accurate than the official forecasts issued to the public by Weather Bureau local offices. Author

N70-17330 National Lending Library for Science and Technology, Boston Spa (England).
ON THE POSSIBILITY OF RESTORING MISSING OBSERVATIONS
A. S. Kaganskij et al 25 Sep. 1969 14 p ref Transl. into ENGLISH from Nauc. Issled. Inst. Aeroklim (Moscow), no. 50, 1968 p 48–54
(NLL-M-7802-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Duplicate matrix calculations are used to obtain correlation functions of daily mean values of hydrometeorological elements and values at observation times to restore missing observations resulting from movements of weather ships. Information calculations were based on ten year observations of 310 daily mean air and water temperatures, and their differences in certain months. Tabulated data indicate that the substitution of duplicates had a favorable effect on the accuracy of correlation functions. J.M.C.

N70-17421# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 40. WASHINGTON, D.C., DULLES INTERNATIONAL AIRPORT Final Report
Jun. 1969 29 p ref
(Contract FA-67-WAI-129)
(RD-69-22-Vol-40) Avail: CFSTI

Tabulated data covering the period 1 January 1963 to 31 December 1965 are presented for Washington, D.C., Dulles International Airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categoreis are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N70-17652# Weather Bureau, Silver Spring, Md. Weather Analysis and Prediction Div.
PRELIMINARY RESULTS OF AN EMPIRICAL STUDY OF SOME SPECTRAL CHARACTERISTICS OF SKILL IN PRESENT WEATHER AND CIRCULATION FORECASTS
Charles F. Roberts Nov. 1969 29 p refs
(ESSA-TM-WBTM-FCST-14) Avail: CFSTI

A pilot study to formulate methodology and provide preliminary indications on the spectral characteristics of errors in weather and circulation forecasting is reviewed. Data were obtained from a temperature-precipitation forecast verification program over an 18-month period and from verifications of numerical prognostic charts. In the development of scale measures to define the spectral properties of the temperature forecasts, the rationale used is: (1) The difference between the value of a meteorological element at two points provides a measure of the amount of variability associated with the scale equal to the separation between the two points. (2) The difference in the forecast value of the element for the two points is the amount of variability forecast for the element in the scale equal to the separation distance. (3) The correlation between the forecast difference and the observed difference provides a suitable measure of the skill with which the component of variability on a scale commensurate with separation distance can be forecast. D.L.G.

N70-17661# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
ANALYSIS OF MAXIMUM GUST EXPERIENCE OBTAINED IN KANSAS AND OKLAHOMA DURING PROJECT LO CAT
Larry A. Roberts Sept. 1969 43 p
(AD-697060; ASD-TR-69-90) Avail: CFSTI CSCL 1/1

The report covers the portion of project LO LO CAT which was flown over Southeastern Kansas and Northeastern Oklahoma. Large quantities of data were taken over a period of 15 months during numerous flights at constant absolute altitudes of 250 feet

and 750 feet (i.e., the flights were conducted in the contour mode). Data were not taken continuously but were recorded in discrete legs each 5-1/2 minutes in length. From each of these 5-1/2-minute data conditions a maximum gust velocity was computed for the vertical, longitudinal, and lateral axes. Tabulations of frequency distributions of these maximum gusts and plots of exceedance probability for a given season at each of the two absolute altitudes are contained in the report. Plots of the average number of nautical miles flown to obtain a given maximum gust level in a given season are aslo included. Author (TAB)

N70-17680 National Lending Library for Science and Technology, Boston Spa (England).
SOME DATA ON THE STRUCTURE OF THE FIELD OF WINTER PRECIPITATION
I. V. Litvinov et al 20 Jul. 1969 9 p ref Transl. into ENGLISH from Glav. Geof. Obs., T. vyp. (Leningrad), no. 230, 1968 p 60–64 (NLL-M-7799-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Correlation functions are presented for precipitation in the Obninsk region, USSR, during the winter of 1965. Precipitation measurements were recorded at three hour intervals by 350 sites. Data obtained over a four month period were analyzed and correlation coefficients for each pair of points were calculated. Only cases in which precipitation was observed at both points were considered. In some cases the number of precipitation measurements differed considerably from those at adjacent points and data from these points were not used. Correlation coefficients were grouped by distance intervals and averaged, with the mean correlation coefficient being allocated to the mean distance in the given range. Results indicate that the correlation functions fall off only slightly with distance, and at different rates in different periods. A table of the calculated correlation coefficients is included. D.L.G.

N70-17709# National Center for Atmospheric Research, Boulder, Colo.
FRONT RANGE MOUNTAIN WAVES
Wim Toutenhoofd *In its* Internal Gravity and Acoustic Waves Sep. 1969 p 309–322 (See N70-17690 06-13)
Avail: CFSTI

Results are discussed from analysis of wave clouds observed in the lee of a mountain range near Boulder, Colorado. Detailed discussion is presented for measurements on one particular by day various types of instrumented aircraft flying at different altitudes along the same course line. R.B.

N70-17726 World Meteorological Organization, Geneva (Switzerland).
PROCEEDINGS OF THE SYMPOSIUM ON HYDROLOGICAL FORECASTING
1969 332 p refs Conf. held at Surfer's Paradise, Australia, 29 Nov.–25 Dec. 1967; Sponsored jointly by WMO and UNESCO *Its* Tech. Note No. 32
(WMO-228-TP-122) Copyright. Avail: WMO, Geneva

Conference papers of the symposium on hydrological forecasting are presented. For individual titles, see N70-17727 through N70-17754.

N70-17727 Commonwealth Scientific and Industrial Research Organization, Melbourne, (Australia). Div. of Plant Industry.
THE SOIL-PLANT-ATMOSPHERE CONTINUUM IN THE HYDROLOGICAL CYCLE
J. R. Philip *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 5–13 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Microprocesses of the hydrological cycle are discussed including the transfer of water in saturated and unsaturated soils, the transfer of water in plants, the transfer of heat and water in the lower atmosphere by turbulent and molecular diffusion and in the air layer occupied by vegetation. These microprocesses should be useful for macrohydrological model-making. ESRO

N70-17728 Hydrometeorological Service of the USSR.
THE MOVEMENT OF FLOOD-WAVES IN NATURAL CHANNELS AND SOME PROBLEMS OF RIVER DISCHARGE AND STAGE FORECASTING
E. G. Popov *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 14–24 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Methods and techniques of short-range river discharge and stage forecasting based on the laws of water flow in channels and on the laws of movement and transformation of flood-waves within limited river reaches are briefly discussed. The period of time which can be covered by such forecasts depends mainly on the wave speed and the length of river reaches. The complexity of unsteady flow in natural channels and the lack of data are the main causes for the approximate nature of the forecasting techniques used at present. Electronic computers now make it possible to use more reliable hydrodynamic methods but their use is limited in many cases by lack of data. ESRO

N70-17729 India. Meteorological Dept., New Delhi.
RESEARCHES IN INDIA ON OBJECTIVE PRECIPITATION ASSESSMENT
S. Banerji and D. V. L. Narasimha Rao *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 28–36 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Owing to the lack of an extensive aerological network in India, former methods of quantitative precipitation forecasting were mostly confined to statistical correlations. Results are given of a pilot study which are only applicable to the tropics where the monsoon is the principal rain-producing ament: (1) the maximum precipitation appears to come from the laser 2 or 3 km above sea-level, (2) for a given value of water content in a layer there appears to be a limiting value of precipitation rate which increases with vertical velocity up to a certain speed, (3) in the method of assessment of rainfall by dynamic trajectories, the area of maximum rainfall was not located at the point of convergence but some distance away upstream, and (4) most observations of heavy rain not more than 80-85% of the total inflow volume of moisture was precipitated. ESRO

N70-17730 Weather Bureau of New Zealand, Wellington.
A CYCLONIC DISTURBANCE IN THE UPPER TROPOSHERE ASSOCIATED WITH WIDESPREAD RAIN OVER SOUTHEASTERN AUSTRALIA
H. W. Hill *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 37–50 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

A case study on an upper level cyclone over eastern Australia during 20-23 April 1964 is presented. The mechanism by which a typical cold cut-off depression becomes an important feature giving widespread precipitation is described. The case discussed indicates that the processes are more akin to the classical warm front with a widespread general ascending motion over the troposphere rather than being produced by virtue of thermal instability. ESRO

N70-17731 Weather Bureau of New Zealand, Wellington.
WIDESPREAD HEAVY RAIN IN NEW ZEALAND ASSOCIATED WITH CYCLOGENESIS OVER THE NORTHWEST TASMAN SEA
H. W. Hill *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 51–65 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

A case study of a heavy rainfall situation over New Zealand during 25-26 April 1966 is presented. It is shown that the process of generation of extensive cloud-sheets and precipitation areas in association with cyclogenesis is one accompanying the large-scale features of the atmosphere, especially associated with jet streams. The large-scale vertical motions are primarily dynamic features, part of the three-dimensional field of motion belonging to the migratory isotach maxima of the zonal westerlies. ESRO

N70-17732 Bureau of Meteorology, Melbourne (Australia).
THE ACQUISITION OF DATA FOR FLOOD FORECASTING
D. N. Body *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 69–72 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Operational flood forecasting systems rely on the observation and rapid transmission of rain data. These two activities are discussed including such modern means as meteorological radar and meteorological satellites. ESRO

N70-17733 Bureau of Meteorology, Melbourne (Australia).
SOME POTENTIAL APPLICATIONS OF METEOROLOGICAL SATELLITES IN FLOOD FORECASTING
A. F. Rainbird *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 73–80 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

The possibility of using satellite observations for the formulation of flood forecases for a river basin and problems encountered are discussed and a cloud-height/rainfall analysis of Southeast Africa from data collected by TIROS satellites is presented. Although at the present time the observation of hydrometeorological parameters by satellite-mounted sensors is still rather coarse, the observing capabilities of satellite sensor-systems are improving rapidly and the possibility of using satellite-gathered infrared radiation data appears feasible in the near future. ESRO

N70-17734 State Rivers and Water Supply Commission, Victoria (Australia).
MATHEMATICAL MODELS OF AREA RAINFALL
G. N. Alexander *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 81–100 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Only by the study of rainfall in three dimensions, will it be possible to obtain a unifying treatment of rainfall distributions suitable for use in flood estimation. Some misconceptions were eliminated and models are postulated that can be tested with the large volume of rainfall data available. The spatial models discussed should assist in estimating flood magnitudes from rainfall. ESRO

N70-17735 Ministry of Construction, Seoul (South Korea).
RIVER FORECASTING TECHNIQUES IN KOREA
Yun Sik Lee *In* WMO Proc. of Symp. On Hydrol. Forecasting 1969 p 103–109 (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

The methods used in the Republic of Korea to evaluate and forecast river stages from upstream observations are described. Some improvements that should be initiated are discussed. ESRO

N70-17736 Bureau of Meteorology, Melbourne (Australia).
DEVELOPMENT OF A FLOOD-FORECASTING SYSTEM FOR THE LATROBE RIVER AT YALLOURN
G. Heatherwick *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 110–132 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Procedures which are currently adopted for the development of flood forecasting systems in Australian conditions are outlined. Operational systems introduced in Australia up to this time were based entirely on the prediction of stream flow direct from rainfall. Because of the need to reduce the volume of data to a minimum, the emphasis was on simplicity. Future developments in the technique of acquiring data, the application of improved catchment models, and the availability of on-line computers may lead to an improvement in the capacity to handle difficult situations. ESRO

N70-17737 Ministry of Public Works, Caracas (Venezuela).
FORECASTING WATER-LEVELS OF THE ORINOCO RIVER IN VENEZUELA
H. Silva and L. Ayala Useche *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 133–138 (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

The methods used to forecast water-levels of the Orinoco River fifteen days in advance are described, and future contemplated improvements are listed. ESRO

N70-17738 Hydrometeorological Service of the USSR.
FLOOD HYDROGRAPH CALCULATION WITH RUN-OFF TRANSFORMATION IN BASIN AND CHANNELS TAKEN INTO ACCOUNT
D. A. Burakov *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 139–146 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Solving hydrograph calculations at the confluence of two largest rivers of the Soviet Union, the Ob and the Irtysh, is presented. The region is extremely flat, with a poor drainage network, and the main phase of the water-regime of the rivers is flood resulting from snow melt. The scheme described can be used for calculation, and forecasts of rainfall run-off from rainfall data in regions with flat relief where overland ran-off transformation is of essential significance. ESRO

N70-17739 University Coll., Galway (Ireland).
FLOOD-WAVE FORMATION
J. E. Nash and J. V. Sutcliffe *In* WMO Proc. of Sym. on Hydrol. Forecasting 1969 p 147–155 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Traditional methods of forecasting discharge from rainfall are analyzed. An experimental model was constructed which was required, not only to forecast the flood wave on a particular catchment, but also to help to understand the working of the hydrological cycle. It is assumed that the catchment, in determining volumes of run-off due to individual rainfall events, is analogous to a vertical stack of horizontal soil layers each of which can contain a certain amount of water at field capacity, each layer being subject to evaporation or wetted in turn. ESRO

N70-17740 Hydrometeorological Service of the USSR.
THE FORMATION AND FORECASTING OF RAINFALL FLOODS
I. N. Gartsman and V. M. Lylo *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 156–161 ref (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

A mathematical model of flood run-offs in the far eastern regions of the USSR, where floods occur repeatedly, is discussed. It leads to a set of equations in which the lag function is the derivative with respect to depletion functions and spatial time distributions of run-off formation. ESRO

N70-17741 Stanford Univ., Calif. Dept. of Civil Engineering.
DIGITAL SIMULATION METHODS FOR HYDROLOGICAL FORECASTING
N. H. Crawford *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 162–171 refs (see N70-17726 06-20)
Copyright. Avail: WMO, Geneva

An operational forecasting technique integrating stream-flow simulation and meteorological forcasts to produce short- and medium-term stream-flow forecasts is presented. Problems encountered, such as lack of available data, data errors and conflicting evidence from the analysis of these data are discussed. The system includes straightforward information display and programming that allows interaction between man and machine during forecast operations. ESRO

N70-17742 Hydrometeorological Service of the USSR.
MATHEMATICAL MODELLING OF THE RUN-OFF PROCESS OF RIVERS WITH COMPOUND ALIMENTATION
J. M. Denisov *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 172–180 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Elaboration of mathematical models of river run-off is fraught with difficulties. Among these are the lack of basic data combined

with a considerable noise level, and the uncertainty of some links in the process. Models of snow-melt run-off on the surface of a mountain drainage basis and some subsequent transformation schemes are described. ESRO

N70-17743 Weather Bureau, Silver Spring, Md.
THE APPLICATION OF CONCEPTUAL CATCHMENT MODELS TO RIVER FORECASTING
T. J. Nordenson *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 181–192 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

The objective of a conceptual catchment model is to simulate as accurately as possible the stream-flow hydrograph under conditions and also to evaluate the modifications of natural flows resulting from man-made physical changes of management practices. Some models such as the Stanford watershed model, the Utah State simulation model, the Columbia River Basin model, and the US Weather Bureau activities are discussed. The trend in modelling is toward the design of more sophisticated and more complex models based on more theoretical logic. ESRO

N70-17744 New South Wales Univ., Kensington (Australia). Water Research Lab.
SHORT-TERM FLOOD FORECASTING WITH THE RETENTION MODEL
F. C. Bell *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 193–207 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

A retention model of hydrography in river basins in Australia is presented. Originally the model was suggested for analyzing the vegetation and soil effect on run-off volumes but it seems just as suitable for short-term forecasting of floods due to rainfall and may have special advantages for large and variable catchments. Although its observational elements are simpler and more flexible than those of other conceptual models, it maintains a reasonable degree of physical reality and should be reliable under a wide range of conditions. ESRO

N70-17749 World Meteorological Organization, Geneva (Switzerland).
ELEMENTS OF PREDICTION OF RUN-OFF FROM SMALL CATCHMENT BASINS
J. Lambor *In its* Proc. of Symp. on Hydrol. Forecasting 1969 p 263–285 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Those countries whose meteorological and hydrological services are at present under development are river-flow forecases, and it seems that this problem no longer causes any major difficulties. Entirely unsettled and in many cases contentious and doubtful, are forecases for small streams, mountain tributaries, and small catchment basins with violent floods of short duration. These situations create very great difficulties both as to forecasting technique and as to the proper organization of the service. The relevant problems are discussed. ESRO

N70-17750 World Meteorological Organization, Geneva (Switzerland).
SEASONAL LOW-FLOW FORECASTING
H. C. Riggs and R. L. Hanson *In its* Proc. of Symp. on Hydrol. Forecasting 1969 p 286–299 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

The utility of seasonal low-flow forecases is greatest in the case of those made farthest in advance. It would be desirable to forecast seasonal low flows many months in advance, but most ground-water aquifers receive their major recharge during a particular season, and it is not possible to estimate the subsequent low flow prior to that season. Thus, even under the most favorable conditions six months is about as far in advance as seasonal low flows can be forecast. Examples are given for sites where gaging stations exist. Forecast can also be made for other sites if some discharge information is available, and a method for doing this is given. ESRO

N70-17752 Hydrometeorological Services of the USSR.
FLOOD-FORECASTING FROM DISCHARGE DATA IN DRAINAGE NETWORKS AND FROM PRECIPITATION
V. I. Sapozhnikov *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 307–311 refs (See N70-17726 06-20)
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Velikanov's equation can be used to compute floods, and this approach is discussed from the point of view of small rivers with watershed areas of a few thousand square kilometers, in which the precipitations are recorded at a few points, but the discharge is only measured at the outlet. ESRO

N70-17753 Hydrometeorological Service of the USSR.
THE METHOD OF INFLUENCE-FUNCTION DETERMINATION FOR LINEAR RUN OFF MODELS
L. S. Kutchment *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 312–319 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

When using field measurements which always contain errors, the initial functions cannot be given with absolute accuracy, and it is not possible to obtain the function in a uniform manner. The theory of incorrect problems developed by Soviet mathematicians is applied to the influence function of the rivers Tvertsa and Svir in the downstream pool of the Ivankov hydroelectric station. ESRO

N70-17754 Hydrometeorological Service of the USSR.
THE COMPUTATION AND FORECASTING OF MAXIMUM FLOOD DISCHARGES
A. B. Kryzmanovska and G. V. Pavlenko *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 320–325 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

The procedure of flood-discharge forecasts of mountain rivers is based on determination of the inflow of rain and snow-melt waters to the up-stream cross-sections of rivers and on transformation calculation of flood waves while they pass the river section to the outlet. More accurate calculations can be performed when computing inflow by run-off in upper cross-sections. These techniques are opposed to the upper mountain part of the Latorica basin. ESRO

N70-18108# Texas Univ., Austin. Atmospheric Science Group.
DIURNAL VARIATION OF KINETIC AND INTERNAL ENERGY IN ONSHORE WINDS ALONG THE UPPER TEXAS GULF COAST
Tsann-wang Yu Jan. 1970 50 p refs
(Grant NSF GA-36X1)
(Rept-19) Avail: CFSTI

Surface wind and temperature data taken from sea breeze experiments during several days of onshore wind occurrence were reduced and analyzed. The mean kinetic energy and its changes normal to the coastline were computed directly from the wind data. A model presents the use of temperature data to calculate internal energy and its horizontal changes in the thermal internal boundary layer. Analyses of these data and the calculated results show a well defined diurnal variation in wind speed, wind direction, air temperature, kinetic energy and its spatial changes, and internal energy and its spatial changes. The characteristics of the diurnal variation are discussed. Author

N70-18110# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADAR PROBING OF THE TROPOSPHERE UNDER CLEAR SKY CONDITIONS
G. B. Brylev 9 Sep. 1969 33 p refs Transl. into ENGLISH from Glavnaya Geofizicheskaya Observ., Leningrad, USSR, no. 231.

1968 p 38 – 54
(AD-696235; FTD-MT-24-160-69) Avail: CFSTI CSCL 4/2

The author discusses the nature and the origins of radar echoes in clear air in the absence of hydrometeors. Four different types are defined: (1) discrete-coherent echo, (2) reflections from inversion layers, (3) reflections from layers containing aerosols, (4) reflections from regions of turbulence. The first type of radar return can be explained either by inhomogeneities in the refractive index of the air or by the presence of insects or birds. The author comes to the conclusion that models based on variations in the refractive index are inconsistent with some important aspects of this phenomenon. On the other hand, eliminating birds as the source of such echoes because the magnitudes of signals due to reflections from birds are several orders of magnitude higher than those under consideration, the hypothesis that insects are the source of the discrete-coherent echoes fully satisfies the meteorological and physical properties of such signals. Reflections from the inversion layers are due to abrupt changes in the refractive index of air caused by the local temperature differences as well as to the presence of aerosols. The latter source is extensively discussed.
TAB

N70-18137# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 41: WASHINGTON, D.C.-WASHINGTON NATIONAL AIRPORT
Final Report
Jun. 1969 32 p
(Contract FA-67-WAI-129)
(ESSA-SRDS-RD-69-22-Vol-41) Avail: CFSTI

The tables contained herein have been prepared and organized for use in evaluating the cost/benefits of all weather landing systems and fog dissipation techniques. Thus, the time intervals of duration of the categories of weather are significant in determining the times of the delay, diversion or cancellation of an aircraft flight resulting from a restricted weather category. This information together with the number and types of aircraft affected by the restricted weather and the costs of a delay, diversion or cancellation combine to provide the total costs resulting from the weather restrictions. Climatological summaries have been prepared for 41 airports.
Author

N70-18199# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CIRCULATION CONDITIONS IN THE MALAYA ALMATINKA RIVER VALLEY DURING THE WINTER
V. P. Kelberg 17 Sept. 1969 19 p refs Transl. into ENGLISH from Tr. Kaz. Nauchn.- Issled. Gidro-Meterol. Inst. Alma-Ata), no. 29, 1967 p 77 – 79
(AD-696327; FTD-HT-23-254-69(JPRS)) Avail: CFSTI CSCL 4/2

During the winter of 1964-1965, approximately one year before the major explosion at Medeo, which was designed to control some of the runoff problems originating in the seley avalanche-floods, a major micrometeorological field study was undertaken to investigate the day-time atmospheric circulation in the Malaya Atmatinka river valley. These data were supplemented by aerological observations made at the Alma-Ata Hydrometeorological Observatory (7 km below the mouth of the valley). The experimental data included 1119 pilot balloon and 1259 gradient observations (temperature and wind measurements) collected at three stations and radiosonde observations from Medeo itself. The investigation covers, in great detail, the frequency of occurrence of typical mountain-valley circulation (three observation stations distinguishing mountain winds, valley winds, calms, and weather conditions which hindered pilot balloon observations, such as precipitation, fog, low clouds etc.). The principal findings of the study of local circulation prevailing in the daylight hours of the winter season are summarized.
Author (TAB)

N70-18238# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF CALCULATING THE TURBULENCE COEFFICIENT IN THE BOUNDARY LAYER OF THE ATMOSPHERE
L. A. Klyuchnikova 13 Mar. 1969 37 p refs Transl. into ENGLISH from Gl. Geofizicheskaya Observ., Leningrad. Trudy (USSR), no. 205, 1967 p 44 – 64
(AD-696548; FTD-HT-23-35-69) Avail: CFSTI CSCL 4/2

The paper is a review of Soviet and foreign literature on determining the profile of the coefficient of turbulence k(z) on the basis of experimental data on actual wind, atmospheric temperature, and structural measurements in the boundary layer. The formulas and data for calculating k(z) used by different investigators and the results obtained are presented. The profile of k is obtained by various methods is usually a curve with a pronounced maximum at altitudes of 100-300 m. An analysis of all the methods shows that in the present stage of investigation into distribution of the turbulence coefficient in the boundary layer of the atmosphere, it is possible to speak only of qualitative results.
Author (TAB)

N70-18241 Pennsylvania State Univ., University Park.
A MESOSCALE NUMERICAL MODEL AND LAKE-EFFECT STORMS
Ronald Leonard Lavoie (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-5569

The usefulness of a single layer model of the atmosphere in simulating the effects of surface inhomogeneities of temperature, roughness, and terrain elevation is studied on the mesoscale. The model is based on the vertical integration of the primitive equations through a well mixed layer. Surface fluxes of heat and momentum are parameterized by bulk aerodynamic methods involving a drag coefficient that depends upon surface roughness only. In order to test the degree of correspondence of the model to reality, several experiments were made with wintertime flow over Lake Erie under conditions known to give rise to the often severe local disturbance, the lake-effect storm. The influence of wind direction upon the configuration and intensity of the disturbance was examined. The sensitivity of the morphology of lake storms described in the literature was verified. There was excellent correlation between the computed deformation of the depth of the mixed layer and climatological cloud and precipitation patterns. The disturbed wind field and the temperature field also corresponded well with available observations.
Dissert. Abstr.

N70-18272 National Lending Library for Science and Technology, Boston Spa (England).
THE AUTOMATIC CONTROL OF MARINE METEOROLOGICAL INFORMATION USING COMPUTERS
B. A. Birman 25 Sep. 1969 11 p refs Transl. into ENGLISH from Gidromet. Nauchn.- Issled. Centr SSSR (Russia), p 3 – 16
(NLL-M-7795-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A system of automatic control of hydrometeorological information was devised which makes it possible for all discrete meteorological parameters to be controlled completely, while effectively detecting incorrect information. Three aspects of automatic control are defined: information, analytical, and technological control. A standard program was written for technical, logical, and meteorological parametric control which can be represented as continuous functions. Algorithms used in the control of meteorological observations are given.
J.M.C.

N70-18273 National Lending Library for Science and Technology, Boston Spa (England).
EPOCHAL MODIFICATIONS OF FORMS OF ATMOSPHERIC CIRCULATION IN THE NORTHERN HEMISPHERE AND ASSOCIATED CHANGES IN THE CHARACTERISTICS OF THE ATMOSPHERE AND HYDROSPHERE

A. A. Girs [1969] 27 p refs Transl. into ENGLISH from Akad. Nauk Mezd. Geofiz. Kom. (Moscow), no. 16, 1968 p 273–286
(NLL-M-7759-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Westerly, easterly, and meridional forms of atmospheric circulation are studied for epoch modification in the northern hemisphere. The frequency of epoch occurrences of westerly circulation was greatest in the spring and summer. Easterly circulation processes were prevalent during the months of July and August, and remained above normal during the months of May, November, December, and January. Meridional circulation was most apparent during the spring and autumn. Characteristic features of the processes of these forms of circulation are outlined along with hydrospheric and atmospheric features. J.M.C.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-16981# Federal Aviation Administration, Atlantic City, N.J. Dept. of Transportation.
EVALUATION OF AREA NAVIGATION IN THE NORTHEAST CORRIDOR Final Report
Bernhart V. Dinerman Jan. 1970 83 p
(FAA Order-NA-70-3; RD-69.53) Avail: CFSTI

The Federal Aviation Administration, Eastern Airlines, and two area navigation equipment manufacturers participated in an area navigation evaluation in the northeast corridor. Area navigation equipment was installed in two Eastern Airlines DC-9 aircraft assigned to commercial shuttle flights between La Guardia Airport, New York; National Airport, Washington; and Logan Airport, Boston. Special area navigation routes, operational procedures, and an evaluation plan were developed. To support operational conclusions, aircraft space position data were collected during flights over area navigation routes and conventional victor airways. The prime measurement source was the New York Air Route Traffic Control Center surveillance radar and secondary beacon radar with a beacon video digitizer output to a specially-developed magnetic tape recorder. Author

N70-16984# Environmental Technical Applications Center (Air Force), Washington, D.C.
RAIN MODELS FOR LANDING GUIDANCE SYSTEMS
Gordon A. Beals Nov. 1969 18 p refs
(AD-696617; ETAC-TN-69-9) Avail: CFSTI CSCL 4/2

Models of rain intensity along an aircraft glide slope are derived for the purpose of comparing attenuation losses at various radar frequencies. The models are intended to portray a rain intensity over a 10-minute period and 10-mile or 20-mile ground track. The rain intensities are selected to represent rates which would occur less than one percent or 0.1 percent of the time during the rainy season at the rainiest airfield in the U.S. and the rainiest airfield (with over 5000 feet of paved runway) in the world. Author (TAB)

N70-17292*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A STUDY OF DISPLAY SYSTEMS FOR MANUAL GUIDANCE OF LARGE LAUNCH VEHICLES UTILIZING THE X-15 AIRPLANE AND FLIGHT SIMULATORS Technical Note
Armando E. Lopez, Gordon H. Hardy, and Ronald M. Gerdes Washington Jan. 1970 20 p refs
(NASA-TN-D-5632; A-3424) Avail: CFSTI CSCL 17G

A study has been made of the effectiveness of display systems for manually guiding launch vehicles with the accuracy required for earth orbit injection. Three guidance systems were investigated in two flight simulators. One guidance display system was implemented on the X-15 research airplane to determine the system's effectiveness in a real flight environment. All three guidance schemes presented to the pilot the errors in altitude and altitude rate with respect to a reference trajectory. The pilot's task was to null the error signals by controlling the vehicle so that its trajectory matched, as closely as possible, the reference trajectory. The results of the simulator study show that the human pilot is capable of guiding a vehicle to a reference trajectory within the accuracy requirements of current manned spacecraft launch vehicles. The results of two X-15 flights with one of the guidance systems indicated no adverse effects of real flight environment. Author

N70-17312*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
THEORY OF THE CORRECTION OF CELESTIAL OBSERVATIONS MADE FOR SPACE NAVIGATION OR TRAINING
Burnett L. Gadeberg and Kenneth C. White Washington Jan. 1970 50 p refs
(NASA-TN-D-5239; A-2449) Avail: CFSTI CSCL 17G

The theory of the correction of celestial observations, made for space navigation, instrument calibration, or training, as well as new theories concerning window refraction and lunar geometrical librations is discussed. It presents, in an easily understood form, essentially all current information on the corrections for celestial observations, providing a sound basis from which the engineer can derive high precision observations. The corrections associated with these observations have been listed and classified. Where the theory has been completed, equations and constants are provided, or indicated, by which the reduction may be effected; in some cases, the equations have been recast in a form convenient for machine computation. Where the theory or knowledge was incomplete, developments are provided, or the requirements to develop the theory are made known. Author

N70-17326# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Systems Research Section.
SELF-CONTAINED METHOD OF LUNAR NAVIGATION
P. H. Savet Dec. 1969 18 p
(RM-463) Avail: CFSTI

The absence of a significant magnetic field on the moon makes necessary the development of a self-contained north-seeking navigational instrument. The gyroscopic technique used on earth will not work on the moon because of the lower gravitational pull and reduced rate of rotation around the polar axis. This memorandum describes a new technique to overcome these limitations. Essentially the technique is based on instrumentation, using off-the-shelf components, that navigates on the lunar surface by solving two basic and to a certain extent unseparable problems: 1) azimuth determination with respect to a reference direction such as north; and 2) determination of the corrected local (nongravitational) vertical. It is shown that directional accuracy achieved becomes comparable to that obtained on earth. Author

N70-17392*# Martin Marietta Corp., Denver, Colo.
FORMULATION ON STATISTICAL TRAJECTORY ESTIMATION PROGRAMS
William E. Wagner and Arno C. Serold Washington NASA Jan. 1970 139 p refs
(Contract NAS1-8500)
(NASA-CR-1482) Avail: CFSTI CSCL 22C

This report documents the theory, equations, and numerical techniques in the statistical trajectory estimation programs (STEP and STEP2). These programs were originally developed and used on the precision recovery including maneuvering entry (PRIME) program to perform the postflight trajectory reconstruction and analysis of the SV-5D maneuverable lifting reentry vehicle. STEP uses the recursive Kalman minimum variance filtering algorithm to fit the equations of motion to trajectory measurement data. The

programs are formulated to process position radar tracking and airborne gyro and accelerometer measurements. The equations of motion account for three dimensional trajectories in the vicinity of an oblate rotating planet. Vehicle maneuvers in pitch, roll, and yaw within the atmosphere are acceptable. STEP1 is restricted to nonthrusting vehicles; STEP2 is applicable to any vehicle recording accelerations, inertial angular rates, and having at least partial radar coverage. Author

N70-17449*# Litchford Systems, Northport, N.Y.
APPLICATION OF VLF NAVIGATION AND AUTOMATIC CALIBRATION OF BAROMETRIC ALTITUDE SENSING TO GENERAL AVIATION AND A NATIONAL UNIVERSAL COORDINATE SYSTEM FOR THE GUIDANCE AND CONTROL OF AIR TRAFFIC Final Report
G. B. Litchford Dec. 1969 158 p refs
(Contract NAS12-2071)
(NASA-CR-86313) Avail: CFSTI CSCL 17G

The plans for experimentally testing the VLF concepts of Omega for application to general aviation guidance and control problems are outlined. These plans are presented in this report, and the use of the "oblique-parallel" nature of the Omega coordinates for direct area navigation are discussed. The potential use of a tone data link for reporting coordinates to the ground or to other aircraft are also examined. Automatic position reporting of Omega coordinates for general aviation usage can provide air traffic control (ATC) data, navigation data, as well as hazard warnings such as, for example, ATC conflicts between like equipped aircraft. A national aviation time standard is proposed for such functions as a "roll-call" concept synchronized each 10 seconds. Author

N70-17603*# Massachusetts Inst. of Tech., Cambridge Experimental Astronomy Lab.
STATE TRANSITION MATRIX FOR INERTIAL NAVIGATION SYSTEMS
Kenneth R. Britting Mar. 1969 13 p ref
(Grant NGR-22-009-229; DSR Proj. 70343)
(NASA-CR-107878; RE-53) Avail: CFSTI CSCL 17G

The error equation for inertial navigation systems is formulated and solved in state space notation. The system is assumed to be moving at a constant celestial longitude rate. The state transition matrix is explicitly derived both for long term and short term operation. Examples are included to demonstrate the ease with which the state transition matrix can be used for error analysis. Author

N70-17673 Maryland Univ., College Park.
THE DESIGN AND POSITION ACCURACY ANALYSIS OF A SATELLITE-BASED RANGE AND RANGE RATE RADIO POSITION LOCATION SYSTEM
Richard Allan Inciardi (Ph.D. Thesis) 1968 210 p
Avail: Univ. Microfilms HC $9.45/Microfilm $3.00 Order No. 69-7216

A comprehensive theoretical design and position accuracy analysis was conducted of a promising satellite-based position location approach employing range and range rate information. The application is position-fixing of non-military marine users and aircraft for navigation and traffic control/advisory purposes. The range and range rate measurement method is original and is based on the active participation of ground station, satellite, and user. The dissertation is divided into two major parts. In the first a thorough probabilistic analysis of position location accuracy is carried out. The second part of the dissertation is concerned with the theoretical design of the measurement system instrumentation at the ground station, satellite, and user. The dissertation concludes with a brief discussion of the application of three analytical techniques, developed for the study of the range and range rate problem, to a wide variety of position location and tracking problems. Dissert. Abstr.

N70-17917*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
SOME APPLICATIONS OF MATHEMATICAL OPTIMIZATION TO AUTOMATIC LANDING SYSTEMS
Duncan Mac Kinnon Nov. 1969 115 p refs
(Contract NAS12-602; DSR Proj. 55-30500)
(NASA-CR-86318; R-651) Avail: CFSTI CSCL 17G

The application of mathematical optimization techniques was investigated: the design of hybrid navigation systems which optimally combine radio aid and inertial navigator measurements, and the optimization of the flight trajectory control systems which use these data. Minimim integral squared error and Kalman-Bucy estimation procedures are used to extract superior estimates of vehicle position, velocity and acceleration. The improved position, velocity, and acceleration data provide the basis for the design of a new set of trajectory control systems which are optimally insensitive to environmental effects such as wind gusts. Numerical optimization procedures which minimize system response to stochastic disturbances are developed. The resulting algorithms are applied to the synthesis of a vertical trajectory control system. Author

N70-18101# United Aircraft Corp., East Hartford, Conn. Research Labs.
AIR TRAFFIC CONTROL SIMULATION MODEL EXPLORATORY STUDY Final Report
C. William Burlin Dec. 1969 29 p ref Sponsored by FAA
(H-170592-1; FAA-RD-70-2) Avail: CFSTI

The problem of simulating the flow of air traffic within a large region of the continental U.S. air traffic control system using the general purpose systems simulator computer programming language has been addressed. A simple small scale model was developed. Results indicated that straight forward extension of the simple model would provide a useful simulation tool for air traffic control system analysis. Computer running time estimates for several large scale problems are provided. Author

N70-18238# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ASPECTS OF AIDS AND PERFECTIONS IN THE TAKE-OFF AND LANDING OF MODERN AIRCRAFT. ZERO-VISIBILITY LANDING FOR HELICOPTERS
M. Fourcade Apr. 1969 19 p Transl. into ENGLISH from the Proc. of the Eighth Congr. Intern. Aeron., Marignane, 22 May 1967, p 1-20 Prepared for MIT
(Rept-(153)-69-309-FRLL) Avail: CFSTI

Helicopters were equipped with an automatic pilot guidance system based on an electronic computer. Variations in longitudinal and lateral attitudes lower than + or - 1 deg; variations in course lower than + or - 1 deg; and variation in altitude lower than + or - 5m in baro-altimeter coupling and lower than + or - .5m in radio altimeter coupling were obtained for normal functioning throughout the entire flight. A guidance axis materialized by a radio-electric beam and a linkage device insuring stability were used from the ground, while the guidance beam receivers, the radio altimeter, an electrical output anemometer, signals, and an automatic pilot coupler were onboard the helicopter. Landing procedures are summarized, as well as the lateral guidance, on-site guidance, and breakdown study. It is concluded that the automatic pilot guidance system may be applied during poor visibility. J.A.M.

N70-18248# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
DEVELOPMENT OF ILS EQUIPMENT FOR ZERO-VISIBILITY LANDING
Apr. 1969 8 p Transl. into ENGLISH from the Proc. presented at the Eighth Congr. Intern. Aeron., (Paris), 29-31 May 1967 p 1-6, p 20-21 Sponsored by MIT
(Rept-(154)-69-310-FRLL) Avail: CFSTI

The technological evolution of ILS equipment is briefly

reviewed, and future trends are indicated. Development of wide-band antennas, constant-impedance modulators, distribution circuits, and monitor channels are mentioned with localizing equipment. Several antennas are discussed in solving glide path problems. The low energy consumption by transistorized equipment permits instantaneous supply by storage batteries and thus simplification of the instruments and an increase of reliability. The present day system is defined by a single antenna array, two emitting instruments, instantaneous automatic balance in breakdowns of functioning equipment, and instantaneous electric supplies. J.M.

N70-18276# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SHORT-LANDING AIDING DEVICE WITH LIMITED GROUND EQUIPMENT
C. Ancona et al Apr. 1969 35 p refs Transl. into ENGLISH from 8th Congr. Intern. d'Aeron. (Paris), May 1967 p 1–35 Sponsored by MIT, Lincoln Lab.
(Rept-152-69-308-FRLL) Avail: CFSTI

Azimuthal and on-site guidance are described for which the ground equipment is limited to a low power marker beacon functioning on hectometric waves. This device allowed variable angles of aircraft-controlled descent. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-17128 Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).
RESEARCH RELATIVE TO THE APPLICATIONS OF NUCLEAR ENERGY Annual Report, 1968 [RECHERCHES RELATIVES AUX APPLICATIONS DE L'ENERGIE NUCLEAIRE]
1968 50 p In FRENCH
Avail: CFSTI

A summary of the work carried out during 1968 at the Belgian Nuclear Research Center is presented. This included research on reactor technology and applied research with fast neutron reactors on nuclear fuel elements, solid state physics, low energy physics, and radiobiology. A chart shows the budget of the center for that year. ESRO

N70-17188# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany) Inst. fuer Flugmechanik.
RELIABILITY OF PARACHUTE SYSTEMS [DIE ZUVERLAESSIGKEIT VON FALLSCHIRMSYSTEMEN]
W. Beduhn *In its* Parachute Eng. and Recovery Systems Sep. 1968 p 310–352 refs In GERMAN; ENGLISH summary (See N70-17176 06-02)
Avail: CFSTI

A model using simplifying assumptions, is developed which allows the computation of parachute system reliability with relatively little effort. For this purpose, it is necessary to consider the reliability of the individual components of a parachute system. The reliability of the complete system can then be computed from the reliability of its components and the parachute packing reliability. For the investigation of the overall reliability by means of a series of instrumented drop tests, the necessary number of tests has to be defined. A method is given which permits the determination of the necessary number of drop tests for a given number of failures. Author (ESRO)

N70-17412# Institutt for Atomenergi, Kjeller (Norway).
MEASUREMENT OF THERMAL SPECTRAL INDICES IN REACTOR CELLS NEAR PLANE ABSORBERS
S. E. Wennemo-Hanssen 1969 49 p refs
(KR-136) Avail: CFSTI

Thermal spectrum effects on plane boron-steel absorbers, covering a wide range of optical thicknesses, have been studied in the UO2/H2O zero power assembly NORA. An integral spectrum property has been determined in terms of a spectrum index defined by the activation ratio of the isotopes Lu-176 and Dy-164. In the experiments the spatial variation of the spectrum index has been measured using a foil technique. The experimental results confirm that the thermal spectrum is considerably hardened near the absorbers. The spectrum transients of the absorbers were found to extend about 1 to 2 pitches into the surrounding lattice. The Monte Carlo code MONTROSA has been used for interpretation of the experimental results. MONTROSA calculates the spatial distribution of the thermal neutron spectrum, based on the Brown–St. John energy transfer model, in unit cells bounded by plane absorbers. Author (NSA)

N70-17446# Central Electricity Generating Board, London (England). Research and Development Dept.
EXPERIMENTAL OBSERVATIONS OF VAPOUR BUBBLE GROWTH IN VARIOUS CONSTRAINED GEOMETRIES
S. J. Board Jul. 1969 28 p refs
(RD/B/N-1418; FRPC/RSWP/P-(69)189) Avail: CFSTI

The growth of vapor bubbles in water at constant uniform superheat in various constrained geometries was observed by high speed photography. Vapor slug growth in tubes was found to be consistent with the assumption of an evaporating liquid film on the walls. Bubble growth in a cluster of 12 simulated fast reactor fuel pins was also recorded; by comparison with growth in an unconstrained geometry it was shown that a liquid film adheres to the fuel pins. The shape of the growing bubble was found to be affected by the presence of the pins only at low growth rates. Author (NSA)

N70-17520# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
THORIUM CARBIDE-URANIUM CARBIDE FUEL REACTOR PROCESSING EXTRACTED FROM HIGH TEMPERATURE REACTORS HTGGR [ETUDE DU TRAITEMENT DES COMBUSTIBLES BICARBURE DE THORIUM-BICARBURE D'URANIUM ISSUS DE REACTEURS A HAUTE TEMPERATURE]
Claude Derrien, Pierre Lesbart, Eric Pianezza, Christian Verry, and Gilles Villain Aug. 1969 125 p refs In FRENCH; ENGLISH summary
(CEA-R-3754) Avail: CFSTI

The object of this investigation is solubilization head-end (from crushing and grinding phase to non included first purification (U-233/Th-232)C2 phase) of pulverulent (200–500 microns diameter) contained in a graphite matrix extracted from thermalised neutrons average flux with an irradiation of HTGCR reactor. After describing different processes, the burn-leach of reactor fuel and graphite matrix was chosen. The technology of burner is original in the nuclear field and still more by utilizing ultra-sound to intensify burning reaction and to minimize the weight of incombustibles. The mixture of Th O2, U3O8, and fission products oxides is solubilised by boiling HNO3 13 M + HG 0.05M. This process is profit-learning in a thorium recuperation and reprocessing point of view. In the opposite case it would be interesting to consider a dry-process which would permit to separate solid Th F4 from gaseous U F6. Author (ESRO)

N70-17547# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
FUEL CYCLES FOR ADVANCED CONVERTERS [CICLI DI COMBUSTIBILE PER CONVERTITORI AVANZATI]
F. Conti, G. Graziani, A. Kind, C. Rinaldini, and C. Zanantoni 1968

37 p refs In ITALIAN; ENGLISH summary Presented at the 10th Intern. Nucl. Energ. Conf., Milan, 12-14 Dec. 1968
(CONF-681219-2) Avail: CFSTI

Various fuel cycles for heavy water moderated reactors and high temperature gas cooled reactors are considered. Fissile isotopes production and consumption and fuel cycle costs are analyzed. Several fuel element geometries and cycle schemes are considered and optimized. Moderation ratio, burn-up and specific power are chosen to minimize the fuel cycle cost. Uranium consumption and Pu production are reported as a function of burn-up for optimized high temperature reactors and heavy water reactors. The data are compared with values typical of pressurized light water reactors. Author (NSA)

N70-17557# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.

COMPUTATION OF RESONANCE ABSORPTION IN SIMPLE TRANSPORT APPROACH IN HWGCR CLUSTER LATTICE CELL

S. Stech Jun. 1969 21 p refs
(ZJE-48) Avail: CFSTI

The inadequate supposition in resonance integral calculations is usually the flat-flux approximation. A method is described in which the neutron flux over the fuel element is expressed by the P-1 transport approach. The fortran computer program for calculation of cell resonance parameters for A-series reactors is described. Author (NSA)

N70-17563# Japan Atomic Energy Research Inst., Ibaraki. Div. of Nuclear Engineering.

NESAP-2: A FORTRAN-IV CODE FOR CALCULATION OF NOISE SPECTRA IN AT-POWER REACTORS

Kaiichi Saito May 1969 43 p refs In JAPANESE; ENGLISH summary
(JAERI-1186) Avail: CFSTI

The present code obtains neutron and temperature noise spectral density in at-power reactors on one-space-point model which has a single group of delayed neutrons and two loops of reactivity feedback via fuel and moderator (including coolant) temperature. Noise equivalent sources are determined by the generalized Schottky formula. Extraneous noise equivalent source with the first-order delay effect is also taken into account. Thermal energies exchanged between fuel and moderater, or removed from coolant by an elementary stochastic event are, however, unknown statistical parameters. It is possible, to perform a parametric survey on these unknowns. An auxiliary routine synthesizes theoretical components of the input noise source by the least square method so as to give the best fit to an experimentally obtained input noise source and determines the values of the unknowns. Author

N70-17594# Atomic Energy Establishment, Winfrith (England).

EXPERIMENTAL PHYSICS STUDIES OF STEAM-COOLED FAST REACTOR LATTICES

M. J. Arnold, W. N. Fox, C. F. Geore, R. Richmond, A. C. Aldous et al Apr. 1969 183 p refs
(AEEW-R-560) Avail: CFSTI; HMSO 25s; BIS $4.95

As part of a general investigation of fast reactors, an assessment study of a steam cooled fast reactor system has been carried out at A.E.E., Winfrith. A programme of experimental measurements in the reactor DIMPLE in support of this assessment study provided data on the K-infinity and breeding gain in lattices of simulated typical steam cooled reactor composition. A mixed-critical reactor arrangement was used in which a small section of fast reactor lattice was made critical by surrounding it with a thermal lattice together with a suitable neutron filtering zone. Measurements were made of k-infinity and the most important capture and fission reaction rates U-238, P-239, U-235. The results indicate that the data set in current use for this assessment significantly underestimates the Pu-239 capture rates. The limits of applicability of the data set are assessed. 34 references. Author (NSA)

N70-17599# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.

TEMPERATURE CONDITIONS IN THE SUPPORT SKIRT OF A NUCLEAR REACTOR PRESSURE VESSEL

Z. Juzova, J. Klatil, J. Kunes, and B. Ulrych May 1969 89 p refs
(ZJE-46) Avail: CFSTI

The pressure vessel of the Czechoslovakian A1 power reactor is supported by a skirt designed in the shape of a diverging cone. The area where the skirt is welded to the pressure vessel head is subjected to strong temperature stresses during startup and shut-down. Three separate institutions performed calculations to determine the magnitude of the temperature stresses from the temperature fields in the support skirt and adjacent parts of the pressure vessel. The methods used and the results obtained are presented and compared. NSA

N70-17600# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.

REACTOR CALORIMETER CALIBRATION THEORY

J. Kott [1969] 36 p refs
(ZJE-49) Avail: CFSTI

The complete reactor calorimeter calibration theory is discussed. Methods of thermal energy accumulation as a result of reactor radiation effects in matter, analysis of reactor calorimeter thermal leakage, relations valid for calculation of the total amount of absorbed radiation energy in the calorimeter sample, and operation regimes of radial-flow reactor calorimeters are included. Differences in temperature distribution of calibration and radiation heatings inside calorimeter samples are analyzed. In the analysis special attention is paid to the adiabatic and isothermic regimes of calorimeters. Also discussed are relations for the calibration analysis of the cooling curves after the radiation heating inside the reactor. As a conclusion, time criteria are summarized determining the equivalence between the calibration and radiation heatings of the radial-flow reactor calorimeter and also given is the survey of materials for which the comparative calculations were effectuated. Author (NSA)

N70-17640# Dilworth, Secord, Meagher and Associates, Ltd., Toronto (Ontario).

CONCEPTUAL DESIGN STUDY FOR THE SUPPORT STRUCTURES, ELEVATING JACKS AND LEVELING JACKS FOR A 500 MeV HYDROGEN CYCLOTRON

W. Kiesners, W. J. F. Bradley, M. A. Fischer, J. D. Stringer, and L. J. P. Tillson Vancouver, British Columbia TRI-Univ. Meson Facility Jul. 1968 50 p Sponsored by TRI-Univ. Meson Facility
(TR-68-1) Avail: CFSTI

Studies of concept feasibility with alternative cost oriented design consideration for the supporting structures indicate that the basic concept of the cyclotron support structure, vacuum tank and magnet gap as established by TRIUMF is feasible. The recommended primary top structure would consist of straight I-section beams welded radially to a stiff center ring. Secondary structure would be bolted to the primary in order that the maximum crane lift be limited to approximately 100 tons. Leveling of the magnet cores would be accomplished by a system consisting of hydraulic actuators for raising, used in conjunction with mechanically motor operated wedges for precise height setting. Protective devices to prevent crushing of secondary coils between vacuum tank and magnet faces have been introduced. It is indicated that these steps will permit greater structural deflections with attendant decrease in beam depth and as such warrant further study. Author (NSA)

N70-17648# Broback (William M.) and Associates, Berkeley, Calif.

CONCEPTUAL DESIGN STUDY AND COST ESTIMATE FOR THE MAIN COILS FOR A 500 MeV HYDROGEN ION CYCLOTRON

O. K. Frederickson Vancouver, British Columbia TRI-Univ. Meson

Facility Nov. 1968 56 p Sponsored by TRI-Univ. Meson Facility (WMB-A-171-IRI: TRI-68-3) Avail: CFSTI

A study has been conducted for the purpose of developing a design for the TRIUMV main magnet coils which was to result in a minimum capital investment when the costs of the coils and the power supply were added together. Two basic designs were considered, one being the more conventional design employing extruded square hollow conductor, the other making use of rectangular conductor bars. As a result of the study, it has been recommended that extruded bar aluminum conductor be employed in the fabrication of the coils and that 60 deg segments be used. The recommended coil design is shown on various figures and drawings along with graphs demonstrating power demands, capital investment costs and operating costs for different conductor materials and different number of coil turns. Author (NSA)

N70-17649# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

THE PRODUCTION OF NUCLEAR GRADE URANIUM DIOXIDE POWDERS FROM AUSTRALIAN ORES

P. G. Alfredson 19 Mar. 1969 19 p refs Conf. held at the Australian Inst. of Mining and Met., Sydney, 10-15 Aug. 1969 *Its* Paper No. 3

(CONF-690815-3) Avail: CFSTI

Power reactors using natural uranium dioxide fuel are of special interest to countries such as Australia that have their own uranium supplies. A wide range of uranium dioxide powders can be fabricated and the ideal one flows readily, presses without the need for binders or lubricants, sinters to the required density, and gives low reject rates at all fabrication stages. Details are given of the dissolution, solvent extraction, precipitation, filtration, drying, and calcination-reduction steps. Solvent extraction from sulphate media is also under study with a view to developing a process to produce a nuclear grade product at the mine treatment plant site. Author (NSA)

N70-17651*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.

TRANSACTIONS OF THE SYMPOSIUM ON RESEARCH ON URANIUM PLASMAS AND THEIR TECHNOLOGICAL APPLICATION, 7-10 JANUARY 1970

1970 103 p refs

(Grant NGL-10-005-088)

(NASA-CR-107857) Avail: CFSTI CSCL 18I

A total of 37 abstracts or long summaries of symposium papers are presented under the following main headings: concepts; containment, flow, and stability; properties of uranium plasmas; nucleonics and radiation; nuclear light bulb engine ; MHD power generator; and nuclear lasers. Four other papers are treated in greater detail: (1) acoustic instability driven by absorption of radiation in gases, (2) gas-core nuclear rocket concept with fuel separation by MHD driven rotation, (3) thermal radiation absorption processes in gas core reactors, and (4) gas-core reactors for MHD power systems. D.L.G.

N70-17668# Eidgenoessiches Institut fuer Reaktorforschung, Wuerenlingen (Switzerland).

PLUTONIUM FUEL MATERIAL PROGRAM Annual Report, 1968 [PLUTONIUM BRENNSTOFFPROGRAM]

Apr. 1969 97 p refs In GERMAN

(FIR-146) Avail: AEC Depository Libraries

A program for irradiation experiments on plutonium oxide materials for thermal reactors was developed. The preparation of the uranium-plutonium carbides, including the steps of UO2 sol preparation, UO2-C mixed sol preparation, gelling process, carbothermal reduction, and quality control, is described. The microscopic and X-ray analysis techniques used for the study of the ceramic materials are discussed. The preliminary results obtained in the irradiation of uranium-plutonium oxide are reported. The processing for the irradiation of the carbides is discussed. The post-irradiation techniques of autoradiography, gamma scanning, and burn-up determination are described. Preliminary results are given. The special laboratory equipment used in this program is described. NSA

N70-17921 California Univ., Berkeley.

PROPAGATION OF PRESSURE WAVES IN TWO-PHASE MEDIA

Louis James Hamilton (Ph.D. Thesis) 1968 301 p

Avail: Univ. Microfilms: HC $13.75/Microfilm $3.90 Order No. 69-10305

A full understanding of how pressure waves propagate in two-phase media is required for the safe design of nuclear reactors. A combined theoretical and experimental investigation of pressure wave (compression and rarefaction) propagation in channels carrying two-phase mixtures under steady flow conditions has been performed. Both two-components (air-water) and single-component (steam-water) mixtures have been studied for a range of void fractions and various phase distributions to evaluate the dependence of the speed of propagation and wave form on the interphase transfer of mass, momentum, and energy. Dissert. Abstr.

N70-18127*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

MULTIGROUP RESONANCE-REGION CROSS SECTIONS FOR TUNGSTEN AND DEPLETED URANIUM FOR USE IN SHIELDING CALCULATIONS

Gerald P. Lahti and Robert M. Westfall Washington Jan. 1970 46 p refs

(NASA-TM-X-1909; E-5155) Avail: CFSTI CSCL 18F

Multigroup capture and scatter cross sections in the resolved resonance region were calculated for tungsten and depleted uranium slabs for use in shielding calculations of neutron transport and capture distributions. Slabs of thickness of 1 to 8 centimeters surrounded by hydrogen or lithium hydride were considered. CAROL was used to generate the cross sections, a method previously observed to preserve the total capture rate in a detailed multigroup neutron transport calculation for a thick resonance absorber. Average cross sections were calculated for a 32-energy-group split (0.4 to 1234 eV) compatible with that used by GAM-II. Group fluxes are also presented permitting further group collapsing either by hand calculations or with an included computer program. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-16926 National Lending Library for Science and Technology, Boston Spa (England).

CONCERNING SCREEN-TYPE REFLECTION GRATINGS, SUPPLEMENT

K. H. Hellwege 18 Jul. 1969 3 p ref Transl. into ENGLISH from Z. Physik (Berlin), v. 111, 1938 p 495–497

(NLL-MINTECH-T-6354-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The formula for the diffraction pattern of screen-type reflection gratings was completed by including those wavelengths for which the term sq cos determining the intensity distribution has a maximum value of 1; the amplitude of the wave diffracted light is doubled because the waves reflected from the ridge and furrow have an integral path difference, and the intensity is consequently four times as great as with the permeable grating instead of the furrows. G.G.

N70-17009 National Lending Library for Science and Technology, Boston Spa (England).
CONCERNING SCREEN TYPE REFLECTION GRATINGS
K. H. Hellwege 18 Jul. 1969 12 p refs Transl. into ENGLISH from Z. Physik (Berlin-Wilmersdorf (West)), v. 106, 1937 p 588–596 Presented at the Lower Saxony Sect. of the Ger. Phys. Soc. in Clausthal, Harz, Germany, 13 Jun. 1937
(NLL-T-6353(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The Fraunhofer diffraction pattern of screen type reflection gratings is calculated with the aid of Kirchhoff's law. The intensity distribution of the continuous spectrum is obtained from the Fraunhofer equation and the wavelengths are extinguished through the participation of the furrows. Results are only valid in the approximation in which Kirchhoff's law correctly represents the diffraction on a rectangular reflecting plane. J.M.C.

N70-17020# Pennsylvania State Univ., University Park. Ordnance Research Lab.
UNDERWATER SOUND SIGNATURES OF FLIGHT VEHICLES
W. L. Baker and J. A. Macaluso 20 Sep. 1969 31 p refs
(Contract NOw-65-0123-d)
(AD-695409; SR-3) Avail: CFSTI CSCL 20/1

A report is given on the development of a model and the analytical procedures that will permit accurate calculations of the characteristics of the underwater sound field of flight vehicles operating over typical sea surfaces. A description is given of the design and verification of a general mathematical model and computational procedure that may be used to compute sound transmission through a rough interface separating two fluids. Agreement between theory and experiment is good for the case of sound transmitted from a loudspeaker source in air through several types of stationary corrugated boundary surfaces to an underwater receiver. The theory appears inaccurate, as expected, when applied to surfaces of very steep slope (i.e., greater than that expected in ocean waves) or when applied in situations wherein the acoustic wavelength in either medium is large with respect to the principal physical features of the surface. A description is also given of a model helicopter rotor designed to provide laboratory data on the behavior of actuator discs near rigid or semirigid (water) boundaries. Author (TAB)

N70-17035# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
DETERMINATION OF HEMISPHERICAL EMITTANCE BY MEASUREMENTS OF INFRARED BI-HEMISPHERICAL REFLECTANCE Final Report, Jan. 1968–Jun. 1969
Fred G. Sherrell (M.S. Thesis - Tenn. Univ., Tullahoma) Nov. 1969 82 p refs Prepared in cooperation with ARO
(Contract F40600-69-C-0001)
(AD-696621; AEDC-TR-69-213) Avail: CFSTI CSCL 20/6

A technique for the experimental determination of spectral, hemispherical emittance of surfaces in the infrared wavelength region is suggested. The technique consists of using an infrared integrating sphere to measure spectral, bi-hemispherical reflectance. The feasibility of the technique is justified both on an analytical basis and, to the extent possible, on an experimental basis. A spectral, bi-hemispherical reflectometer is described. The device produces reflectance measurements with an estimated uncertainty of plus or minus 2 per cent of full scale at 5 microns. Due to detector noise the estimated uncertainty increases to plus or minus 10 per cent of full scale at 16 microns. Reflectometer measurements of the spectral hemispherical emittance of fused quartz in the 5 to 16 micron range are presented to illustrate operation of the reflectometer. It is concluded that the device has high potential as an analytical instrument and that developmental efforts should be directed toward extending its wavelength range. Author (TAB)

N70-17080# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A MAGNETIC FIELD IN A CHANNEL OF RHOMBOIDAL CROSS-SECTION IN THE PRESENCE OF A STEEL MAGNETIC CONDUCTOR
S. A. Gamzaeva et al 24 Mar. 1969 16 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Izv. Energ. i Transp. (Russian), no. 2, 1968 p 28–33
(AD-696604; FTD-HT-23-876-68) Avail: CFSTI CSCL 20/3

A boundary-value problem for a magnetic field in a channel of rhomboidal cross-section is considered. The excitation winding of arbitrary thickness encompasses the entire parameter of the channel and is located within the magnetic conductor. The winding has the form of a square at the boundary of the magnetic conductor. Graphs have been plotted of the distribution of the magnetic lines of force and of the vertical component of induction. A comparison has been made of magnetic systems of various configurations with and without a steel magnetic conductor. TAB

N70-17209# Arizona Univ., Tucson. Optical Sciences Center.
TWO-SURFACE OPTICAL SYSTEMS WITH ZERO THIRD-ORDER SPHERICAL ABERRATION
O. N. Stavroudis 15 Apr. 1969 45 p refs
(Contract F44620-69-C-0024)
(AD-696891; AFOSR-69-2752-TR; TR-37) Avail: CFSTI CSCL 20/6

The report derives four one-parameter families of two-surface optical systems having the property that, relative to a well-defined pair of conjugate points, one finite and the other infinite, third-order spherical aberration is zero. The two surfaces can be either refracting or reflecting. Aperture planes are defined for which third-order astigmatism is zero. An expression for coma is also derived. Assuming that the systems will be constructible, a means of defining domains for the free parameter is indicated. Possible applications of these results to optical design are included. Author (TAB)

N70-17220# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
OPTICAL METHODS OF MEASURING TURBULENCE
M. S. Vasudevan and R. E. W. Jansson Jul. 1969 109 p refs
(AASU-288) Avail: CFSTI

The conventional methods of observing turbulent flows were reviewed briefly and provide new workers in the field with a starting point. More particular attention was paid to the techniques involving correlation theory which can give such useful parameters as scale lengths and convection speeds, with reasonable spatial resolution. In the appendices, outlines of the necessary theory are given. The newer laser techniques are also reviewed; in principle these allow the velocity vector to be measured at any point in the flow field. The practical possibility of obtaining such point information and its value are discussed, and a form of apparatus is proposed which would allow the simultaneous determination of average properties of the flow (through correlation theory) and the velocity probability distribution function (using laser-Doppler apparatus). The direction of future work to be undertaken in this department is outlined. Author (ESRO)

N70-17289*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FOURIER TRANSFORM REPRESENTATION OF AN IDEAL LENS IN COHERENT OPTICAL SYSTEMS
Gerald J. Grebowsky Washington Jan. 1970 66 p refs
(NASA-TR-R-319) Avail: CFSTI CSCL 20F

This document presents a mathematical analysis of the approximations required to obtain the Fourier transform representation of an ideal lens. An attempt is made throughout the paper to demonstrate the physical significance of the approximations, and the variations from ideal results, produced by neglected terms in the mathematical formulation. The

approximations involved are considered in terms of the output signals in optical spectrum analyzer, optical imaging, and optical correlator systems. Author

N70-17325# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ENERGY RELATIONSHIPS WITH NANOSECOND MAGNETIC REVERSAL OF MAGNETIC FILMS [ENERGETICHISKAYA SOOTNOSHENIYA PRI NANOSEKUNDOM PEREMAGNICHIVANII MAGITNIKH PLENOK]
A. L. Frumkin Sep. 1969 11 p refs Transl. into ENGLISH from Izv. VUZ Fiz., (USSR), no. 12, 1968 p 49–54 Prepared by Aztec School of Languages, Inc.
(AZT-69-484-RULL) Avail: CFSTI

The rotation of energy and dynamic hysteresis loops with magnetic reversal of magnetic films in a theoretical framework of uniform rotation, and also in the case of real films is examined. The treatment of the experimental data shows that in real films, the relationship between different aspects of the absorbing energy is different than in the theoretical case. A portion of the energy, apparently, accumulates in the film for a time comparable to the duration of the magnetic reversal and affects the course of the magnetic reversal both before and after the disruption of uniform rotation. Author

N70-17390# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STRUCTURE OF SIMPLE LIQUIDS [STRUCTURE DES LIQUIDES SIMPLES]
Jean-Francois Blain Nov. 1969 28 p refs In FRENCH; ENGLISH summary
(CEA-R-3876) Avail: CFSTI

X-ray and neutron scattering were used for investigations on argon and sodium. The principal models used to represent the structures of simple liquids, such as mathematical models, lattice, and experimental models are also considered. Author (ESRO)

N70-17407# European Space Research Inst., Frascati (Italy).
THE OSCILLATORY MOTION OF THE MAGNETOPAUSE AND THE EARTH'S BOW SHOCK
G. R. Smit *In* ELDO/ESRO Tech. Rev., Vol. 1, No. 3 1969 p 255–299 refs (See N70-17406 06-34)
Avail: CFSTI

After an introductory description of the main aspects of the interaction of the solar wind with the geomagnetic field, a discussion of the observed boundary movements is given. They are distinguished in two classes: a fast motion with a period varying between 6 and 10 minutes and an amplitude of 0.1 to 2 R sub E, and a slow motion with a period of 20 to 100 minutes and an amplitude of 0.5 to 3 R sub E. A model is proposed in which the fast mode for the magnetopause is related to a resonance motion of the nose region driven by fluctuations in the solar wind. The fast motion of the bow shock is discussed by considering the motion of an attached curved shock wave in the unsteady supersonic gas-dynamic flow around an oscillating axially symmetric obstacle, representing the magnetosphere. The slow motion of the two surfaces is interpreted as an 'adiabatic' compression and expansion reflecting slow changes of the solar wind characteristics. The relevance of the Helmholtz-Kelvin instability for the fast mode is discussed, and the relationship is considered between the fast boundary motion and the existence of standing Alfven waves inside the magnetosphere. Author (ESRO)

N70-17411# European Space Research and Technology Center, Noordwijk (Netherlands).
HIGH EFFICIENCY REFLECTING SURFACES FOR THE VACUUM ULTRAVIOLET
B. Feuerbacher, B. Fitton, and W. Steinmann *In* ELDO/ESRO Tech. Rev., Vol. 1, No. 3 1969 p 385–403 refs (See N70-17406 06-34)
Avail: CFSTI

The reflectance of clean aluminum surfaces and of aluminum surfaces overcoated with LiF or MgF2 was studied in the 1050 to 1600 A wavelength region under ultra high vacuum conditions. Pure Al surfaces showed a higher reflectance than previously measured, namely 91% at 1216 A, yielding a damping constant in the Drude model of 1.3 × 10 to the minus 15th power sec. A slight dip in the reflectance curve near 1300 A could be strongly enhanced by using a rough substrate and was shown to be due to the excitation of surface plasma oscillations via the surface roughness. A change in the reflectance and in the photoemission during the early stages of deliberate oxidation was observed. Although the reflectance stays nearly constant, a drastic decrease in photoelectric yield starts after fractions of a monolayer of oxygen have been taken up. Overcoating shows that considerable improvements in reflectivity are gained as compared to the values found previously. For MgF2, overcoating the reflectance was found to be 90 + or - 2% for wavelengths longer than 1250 A. For LiF-protected mirrors, the same reflectance was obtained for wavelengths longer than 1300 A, while from 1050 to 1300 A it was higher than 75%. Author (ESRO)

N70-17483# Akademiya Nauk URSR, Kiev. Inst. Electrodinamiki.
DETERMINING THE MECHANICAL FORCES IN AN ELECTROMECHANICAL SYSTEM HAVING A PERMANENT MAGNET
A. N. Milyakh and V. V. Kozorez *In its* Electromagnetic Processes in Converting Devices 1967 p 40–44 ref In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The problems of determining the forces in an electromechanical system having a permanent magnet are considered in which energy accumulators of electrical and magnetic fields are not present. The energy is represented as a power function of the variables of the system. New expressions are derived for calculating the force in the direction of any mechanical coordinate. Transl. by H.W.

N70-17485# Akademiya Nauk URSR, Kiev.
COMPLEX SURFACE RESISTANCE AND EQUIVALENT MAGNETIC PERMEABILITY OF FERROMAGNETIC BODIES
A. A. Berezovskiy, L. P. Nizhnik, and A. N. Kravchenko *In its* Electromagnetic Processes in Converting Devices 1967 p 50–60 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

Methods are shown for calculating the equivalent magnetic permeability. The methods comprise either direct measurement or analytical calculation of the permeability from known magnetic permeability according to the first harmonic or according to the system of symmetrical static hysteresis loops for a given material. Transl. by H.W.

N70-17486# Akademiya Nauk URSR, Kiev.
THE ELECTROMAGNETIC FIELD AND LOSSES OF A SYSTEM OF STRAIGHT, INFINITELY LONG ac CONDUCTORS ABOVE A CONDUCTING HALFSPACE
A. N. Kravchenko and L. P. Nizhnik *In its* Electromagnetic Processes in Converting Devices 1967 p 61–72 refs In RUSSIAN (See N70-17478 06-09)
Avail: CFSTI

The electromagnetic field and specific and general losses from a single ac conductor are calculated. The solution of the problem is given in the form of specific integrals and also in the form of approximation formulas and graphs which permit calculation of the electromagnetic field and losses in the conducting medium with sufficient accuracy for practical purposes. Transl. by H.W.

N70-17826 National Lending Library for Science and Technology, Boston Spa (England).
CONTRIBUTION TO THE ELECTRICAL BREAKDOWN IN VACUUM

R. N. Sudan et al 21 Aug. 1969 26 p refs Transl. into ENGLISH from Arch. Elektrotech. (Berlin-Wilmersdorf (West)), v. 51, no. 2, 1966 p 101–109 In GERMAN and ENGLISH
(NLL-CE-Trans-4896D-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

A hypothesis to explain the electrical breakdown in vacuum between metallic electrodes at room temperature is presented. Anode material is known to be transferred to the cathode in the pre-breakdown stage. It is postulated that this material piles up into points under the action of the electric field at the cathode to enhance this field considerably above its average value. The field emission current from these emitting center heats the anode and luminous spots on the anode are observed. Breakdown occurs when the incident energy at any anode spot exceeds that which can be removed by conduction and radiation for example, thus resulting in the release of metal vapour. Experiments are presented in support of this hypothesis. A high voltage post-breakdown discharge is discussed, which is a self-sustaining flow of electron current form "emitting centres" limited only by the regulation of the supply. Author

N70-17643# TRI-Univ. Meson Facility, Vancouver (British Columbia).
METHOD OF LOCATING THE MAGNETIC CENTRE OF A QUADRUPOLE MAGNET
Roland W. Cobb (Victoria Univ., British Columbia) and R. M. Pearce (Victoria Univ., British Columbia) Feb. 1969 8 p refs
(TRI-69-2) Avail: CFSTI

A stack wire carrying an ac current with a square wave form is shown to take up a stable position on the axis of a quadrupole magnet. The stability condition is derived in terms of current, frequency, wire density, and field gradient. The accuracy with which the magnetic centre can be located is limited by kinking of the wire. Author (NSA)

N70-17973# Massachusetts Univ., Amherst. Polymer Research Inst.
THE THEORETICAL TREATMENT OF THE ORIGIN OF LIGHT SCATTERING ARISING FROM ANISOTROPIC REGIONS SURROUNDING GROWING BUBBLES IN A VISCOELASTIC LIQUID Technical Report
Garth L. Wilkes and Richard S. Stein Oct. 1969 13 p refs
(Contract NONR-3357(01))
(AD-696581; ONR-TR-122) Avail: CFSTI CSCL 20/6

A recent paper by the authors presented an explanation on how the stress or strain fields surrounding a void or inclusion within a solid could give rise to light scattering. This scattering resulted from the associated anisotropy. This report applies that treatment to the strain field surrounding growing bubbles in a viscoelastic liquid. Equations showing a dependence of the scattering on the bubble size and bubble growth rate are developed. TAB

N70-18051# Naval Research Lab., Washington, D.C.
SCATTERING BY SPHERICALLY SYMMETRIC INHOMOGENEITIES Interim Report
George V. Frisk 7 Oct. 1969 57 p refs
(AD-696528; NRL-6943) Avail: CFSTI CSCL 20/1

The Jost function formulation of quantum scattering theory is applied to classical problems involving the scattering of a scalar plane wave by a medium in which the velocity is a function only of the spherical radial coordinate. This technique is used to solve the radial differential equation for scattering from a constant spherical inhomogeneity and from two constant concentric spherical inhomogeneous layers and is compared with the standard method of partial waves for these two cases. The radial equation can be converted into an integral equation incorporating the Jost boundary conditions. The l = 0 partial wave integral equation for a constant inhomogeneity is solved using an iteration procedure (the first two iterations are considered). Author (TAB)

N70-18096 Pittsburgh Univ., Pa.
NUMERICAL ANALYSIS OF TOTAL LOSSES AND MAGNETIC FIELD DISTRIBUTION IN FERROMAGNETIC SOLID TOROIDS
M. Edgardo J. Ibacache (Ph.D. Thesis) 1968 216 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-6398

From the Maxwell's curl equations and the equations for the macroscopic scalar parameters of isotropic and homogeneous medium a general equation is obtained for the components in conducting ferromagnetic media, employing a general orthogonal coordinate system with metric coefficients. The eddy-current and hysteresis losses are calculated and shown to be in good agreement with corresponding test values. A further application of the numerical solution to the toroidal problems is also made in ferromagnetic hollow toroids, where special boundary conditions are taken into account. Employing the same computer programs, results for toroids of small diameter are obtained and presented as an estimation for the true values of flux densities and losses. Dissert. Abstr.

N70-18161# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SYMPOSIUM ON NONLINEAR OPTICS, YEREVAN, 20–27 OCTOBER 1967
Jan Blabla (Czech. Acad. of Sciences) Jun. 1969 6 p Transl. into ENGLISH from Ceskoslovensky Casopis Fysiky, (Prague), v. 18, 1968 p 474–475 Sponsored by MIT
(Rept-(92)-69-147-CZLL) Avail: CFSTI

Papers presented at the international conference are summarized. Studies on nonlinear properties of materials emphasized phenomena in semiconductors and metals, and the polyphoton processes in powerful optical fields. Attention was devoted to the interaction of light waves in nonlinear mediums, and especially the autofocusing of an intense laser beam. Experimental research on forced diffusion of light centered on Brillouin scattering in solids, liquids, and gases. Methods of nonlinear optics included considerations of parametric lasers, frequency shifting in crystals and liquids, coherent radiation detection, and polyphoton stimulation in semiconductors. The production of stimulated radiation in organic dyes is also mentioned. N.E.N.

N70-18168# Lockheed Missiles and Space Co., Palo Alto, Calif.
PLANE ELECTROMAGNETIC WAVE SCATTERING BY A PERFECTLY CONDUCTING SPHERE
V. F. Kulko et al 1969 6 p refs Transl. into ENGLISH from the book "Otbor i Peredacha Informatsii" Kiev, Naukova Dumka Press, 1969 p 16–21
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Mathematical expressions are developed to compute the field of plane electromagnetic wave scattering for use in high frequency electrical prospecting. The fundamental regularities of the electromagnetic field behavior are determined, and the secondary electromagnetic field due to reflections from the sphere is considered. N.E.N.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-18947# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
STRESS INDUCED QUADRUPOLE SPLITTINGS OF LI-7 NMR IN KCL/LI(+)
D. W. Alderman and R. M. Cotts Oct. 1969 55 p refs

(Grant NSF GP-9343)
(Rept-1257) Avail: CFSTI

Measurements of stress induced first order electric quadrupole splittings of the Li-7 NMR line in KCl:Li(+) are reported for the temperature range 1.3 to 4.2 K. Data are presented for uniaxial stresses up to −287 bar applied parallel to [001], [110], and [111] with the magnetic field rotated in the plane perpendicular to the stress. No splitting is observed for stress parallel to [001]. For stress parallel to [110] a splitting proportional to sin sq beta is observed, where beta is the angle between the magnetic field and [001]. A splitting independent of magnetic field direction is observed for stress parallel to [111]. Data for the temperature and stress dependence of the quadrupole splitting with stress parallel to [110] and the magnetic field parallel to [110] is presented. By fitting the temperature and stress dependence data with an LCAO tunneling model a value is obtained for the quadrupole interaction of a nucleus localized in one well. Author

N70-16992# Nihon Univ., Tokyo (Japan). Dept. of Physics and Atomic Energy Research.
BOSE QUARKS AND NON-LEPTONIC WEAK INTERACTIONS
Tetsuo Goto, Osamu Hara, and Shin Ishida [1969] 5 p refs
(NUP-A-69-9) Avail: CFSTI

Quarks obeying Bose statistics, regardless of a half spin, are studied and are shown to lead to a satisfactory understanding of the nonleptonic weak interactions. The Hamilton interaction contained only singlet and octet of the SU(3) symmetry. The phenomenological rule for analyzing the changing nonleptonic decay processes was confirmed. The Bose quark assumption does not change the usual commutation relations among bilinear quantities in quark fields; therefore, there is a possibility that the results of the current algebra are valid. Difficulties in the scheme are experienced from breaking the sacred spin statistics connection. J.A.M.

N70-17042# Illinois Univ., Urbana. Charged Particle Research Lab.
SECONDARY ELECTRON EMISSION FROM LIQUID INSULATORS
Tim Erin and Charles D. Hendricks, Jr. Aug. 1969 80 p refs
(Contract AF-AFOSR-1508-68)
(AD-697054; CPRL-4-69; AFOSR-69-2148TR) Avail: CFSTI
CSCL 20/3

The secondary electron emission properties of some liquid insulators are investigated. The secondary emission ratio, or yield, is measured for three silicon fluids. A secondary electron emission model for liquid insulators was developed so that the mechanism could be compared to that of metals. The model was based on the energy loss of the primary electrons and the probability that an excited electron would escape from deep within the material. The model used as its basis the free electron theory of metals, and was much better for liquid metals than for solid metals. The model can be used to qualitatively explain the secondary emission from liquid insulators and shows that with the insulators lower stopping power and greater escape depth, the yield curve should be very similar to that of the metals; this result was verified experimentally. Author (TAB)

N70-17054# Institute for Nuclear Physics Research, Amsterdam (Netherlands).
SPHERICAL SCATTERING CHAMBER, PART 2 [DE BOLSTROOIINGSKAMER, DEEL 2]
K. Mulder, J. E. J. Oberski, R. v. Dantzig, L. A. Ch. Koerts, H. J. M. Akkerman et al [1968] 51 p In DUTCH
(Rept-67/3) Avail: CFSTI

Operational and geometrical properties of a spherical scattering chamber are described and the placements possibilities of N(≥ 66) detector units are evaluated. The scattering chamber is subdivided into several concentric arranged spherical units and through its center passes the particle beam. A supplement contains the documentation for a stacked configuration of 64 detector units; described are coordinates for collimating direction and a capture curve for detector surface sensitivity against the perpendicular transverse angle of the passing beam for 48 equal distances. Transl. by G.G.

N70-17055# Institute for Nuclear Physics Research, Amsterdam (Netherlands).
PARTICLE ENERGIES IN THE SYNCHROCYCLOTRON [ENERGIE VAN DEELTJES IN HET SYNCHROCYCLOTRON]
W. van Genderen and G. Luijckx [1968] 17 p In DUTCH
(Rept-68/6) Avail: CFSTI

Developed was an Algol program for calculating energy and other particle properties as a function of synchrocyclotron accelerator beam. This was necessary in order to determine the conditions whereby acceleration takes place in a weak magnetic field but at high energies where not only protons but also helium-3 ions are produced. Calculations were performed for three values of the magnetic field; other values can be interpolated. Determined were energy, ratios of velocity/light velocity, frequencies, frequency fluctuations, and the field index of the magnetic field magnitude necessary for determining fast oscillations. Transl. by G.G.

N70-17056 Institute for Nuclear Physics Research, Amsterdam (Netherlands).
KINEMATICS OF MANY-PARTICLE REACTIONS [KINEMATIKA VAN VEELDEELTJES-REAKTIES]
A. D. Ijpenberg [1969] 39 p refs In DUTCH
(Rept-68/4) Avail: CFSTI

Classical and relativistic aspects of many-particle mechanics in nuclear reactions are discussed. Relative energy calculations are performed for general n-particle reactions, two-particle reactions, and three-particle reactions. Kinematic relativistic calculation methods cover the Lorentz transformation in n-particle reactions as well as two- and three particle reactions. Transl. by G.G.

N70-17117# Strasbourg Univ. (France). Faculte des Sciences.
ANALYSIS OF THE FRAGMENTS A EQUALS 8 EMITTED DURING THE INTERACTION OF THE 19 GeV/c PROTONS WITH A GOLDEN TARGET AND DETECTED IN THE CELLULOSE NITRATE [ANALYSE DES FRAGMENTS A EQUALS 8 EMIS LORS DE L'INTERACTION DES PROTONS DE 19 GeV/c AVEC UNE CIBLE D'OR ET ENREGISTRES DANS LE NITRATE DE CELLULOSE]
Raphael Aiguabella (Ph.D. Thesis, 1 Jul. 1969) 1969 53 p refs In FRENCH Sponsored by ESRO
Avail: CFSTI

In order to be able to interpret charge and mass spectra in corpuscular cosmic rays, it is necessary to evaluate the mean free path and the formation rate of particles due to the fragmentation of these ions. This analysis was performed with high energy protons (19 GeV/c) interacting with Be, C, Ag, Al, and Au targets. It is shown that recording the traces in cellulose nitrate is as informative as using ionographic emulsions. Due to the relative incensitivity of plastics to X-rays this detector is suitable for recording high fluxes of heavy fragmentation ions. ESRO

N70-17118# Strasbourg Univ. (France). Faculte des Sciences.
THE CROSS SECTIONS OF FORMATION OF LIGHT ISOTOPES RESULTING FROM THE INTERACTIONS OF THE 70 MEV ALPHA PARTICLES AND C AND N NUCLEI CONTAINED IN THE IONOGRAPHIC EMULSION IN VIEW OF THE STUDY OF THE NUCLEOGENESIS PHENOMENON [SECTIONS EFFICACES DE FORMATION DES ISOTOPES LEGERS DANS LES INTERACTIONS DE PARTICULES ALPHA DE 70 MEV AVEC LES NOYAUX C ET N DE L'EMULSION IONOGRAPHIQUE EN VUE DE L'ETUDE DE LA NUCLEOGENESE]
Carmen Balxeras-Aiguabella (Ph.D. Thesis, 4 Jul. 1969) 1969

78 p refs In FRENCH
Avail: CFSTI

Spallation reactions due to 70 MeV alpha particles were analyzed, and the formation cross-sections for lithium, boron, and beryllium were determined with a nuclear emulsion prepared in the synchroncyclotron at Karlsruhe. The results obtained are presented, and a semi-empirical formula is developed. Models for the synthesis of these elements on the solar system are discussed. ESRO

N70-17120# International Centre for Theoretical Physics, Trieste (Italy).
THE CONTRIBUTION OF DEUTERON BREAK-UP CHANNELS TO DEUTERON STRIPPING AND ELASTIC SCATTERING
R. C. Johnson (Surrey Univ.) and P. J. R. Soper Oct. 1969 44 p refs Submitted for publication Sponsored partly by Roy. Soc. London Prepared jointly with Surrey Univ.
(IC-69-128) Avail: CFSTI

A model of deuteron stripping and elastic scattering is presented which treats explicitly the contributions from channels in which the deuteron is broken up into a relative S-state, and the target is in its ground state. An adiabatic treatment of these channels leads to a description of deuteron stripping which resembles the distorted wave Born approximation. The adiabatic approximation is shown to give a good account of 21.6 MeV elastic deuteron scattering from Ni, at least for surface partial waves, and is expected to apply to other nuclei in this mass and energy region, as well as at higher energies. The calculations assume that the effective two nucleon-nucleus interaction is the sum of the nucleon optical potentials evaluated at half the incident deuteron kinetic energy. Some possible corrections to this assumption are discussed. Author (ESRO)

N70-17158# Pennsylvania Univ., Philadelphia. Dept. of Physics.
PERTURBED ANGULAR CORRELATION STUDY OF ELECTRIC-QUADRUPOLE INTERACTIONS IN 172 Yb IN THULIUM METAL AND OXIDE LATTICES
Robert L. Rasera and Angela Li-Scholz Oct. 1969 49 p refs
(Contract N00014-67-A-01216)
(AD-696988; TR-1) Avail: CFSTI CSCL 20/12

Electric-quadrupole hyperfine interactions at ytterbium ions in thulium metal and Tm203 have been investigated at 296 degrees K using time-differential perturbed angular correlation in gamma-ray cascades in 172Yb. The ratio of the spectroscopic quadrupole moments of the 1174-keV and 79-keV states in 172Yb was measured to be Q(1174)/Q(79) = 1.33 plus or minus 0.15. Using this ratio and a value for Q(79) obtained from the Coulomb-excitation transition probability, the magnitudes of the electric-field gradient tensors are obtained. Author (TAB)

N70-17157# Brown Univ., Providence, R.I. Div. of Engineering.
FEASIBILITY OF PHONON DIFFRACTION IN LIQUID HELIUM Final Report
E. T. Kornhauser 10 Nov. 1969 8 p refs
(Grant AF-AFOSR-193-66)
(AD-697098; AFOSR-69-2858TR) Avail: CFSTI CSCL 20/13

This project was an experimental attempt to demonstrate the feasibility of diffraction by a grating of thermal phonon radiation in a helium bath at temperatures below 0.3K. If such feasibility could be established, the technique could be exploited to develop a phonon monochromator for experiments in electron-phonon interactions, for example, and to develop a means of measuring phonon spectra of solids directly. For reasons of experimental difficulty, such feasibility was not demonstrated, and appears very doubtful. Author (TAB)

N70-17162# Australian National Univ., Canberra. Research School of Physical Sciences.
EVIDENCE FOR INTERMEDIATE STRUCTURE IN THE COMPOUND NUCLEUS Mg-24
J. Hellstroem, P. J. Dallimore, and W. F. Davidson [1969] 8 p refs
(ANU-P/457) Avail: CFSTI

Evidence for the presence of an intermediate nuclei structure from the analysis of inelastic proton scattering from Na-23 is presented. Three possible reaction mechanisms are considered in the analysis. These are direct, compound nucleus or statistical, and the intermediate structure of doorway state reactions. The results of excitation functions for proton elastic scattering from Na-23, measured in 20 keV steps between 8.00 and 12.00 MeV are graphed. It is concluded that gross structure of Mg-24 is definitely present in the reaction, and this structure has the properties to be expected of an intermediate structure. F.O.S.

N70-17214*# Wisconsin Univ., Madison. Physics Dept.
THE VARIATIONAL METHOD 4. LOWER BOUNDS FOR THE ENERGY
Saul T. Epstein 21 Oct. 1969 58 p
(Grant NGL-50-002-00)
(NASA-CR-107841; WIS-TCI-361) Avail: CFSTI CSCL 20/H

Lower bounds are examined in order to obtain bounds on 'mixed second order properties.' With both upper and lower bounds, purely theoretical predictions may be made complete with + or - error. Topics discussed include: the Weinstein-MacDonald bracketing theorem, the Stevenson-Crawford and Temple-Kohn-Kato lower bounds, Lehmann-Maehly bounds, upper bound formulae, Rebane bounds and perturbation theory, operator comparison methods, intermediate Hamiltonians, energy dependent truncation, one-dimensional form of Lowdin bracketing theorem, and bracketing functions for intermediate Hamiltonians. E.C.

N70-17216# Technische Hochschule Munchen (West Germany).
EFFECT OF THE CHEMICAL BOND ON THE RADIOACTIVE DECAY CONSTANT OF Be-7 [EINFLUSS DER CHEMISCHEN BINDUNG AUF DIE RADIOAKTIVE ZERFALLSKONSTANTE VON BE-7]
Heinrich W. Johlige (Ph.D. Thesis) 25 Jun. 1969 87 p refs In GERMAN
Avail: CFSTI

Outer electrons of lighter elements contribute substantially to the electron density at the atomic nucleus and thus have a pronounced effect on half-life. Differential ionization chamber measurements on radioactive decay of two differing beryllium compounds were performed in order to determine the electron capture processes of the atom shell in proportion to the electron density at the atomic nucleus. Comparison of half-life time variations and decay constants confirmed the different electron densities at beryllium nuclei in different chemical compounds. Electron density calculations for the Be nucleus of the Be-atom and the BeH2-molecule showed that the density of the Be-nucleus in the BeH2 molecule was about 0.77 percent lower than the density in the Be-atom. Transl. by G.G.

N70-17223# Australian National Univ., Canberra. Research School of Physical Sciences.
THE Si-29(p,gamma)P-30 AND Si-29(p,p-prime gamma)Si-29 REACTIONS FROM 1300 TO 1850 keV
G. U. Din [1968] 19 p refs
(ANU-P/464) Avail: CFSTI

Proton capture resonances in the Si-29(proton, gamma)P-30 reaction and the yield of 1.27 MeV gamma rays from inelastic scattering of protons from Si-29 have been studied in the range E sub p = 700-1850 keV. The measurements were made using thin enriched Si-29O2 targets on tungsten backings with a proton beam energy resolution of 1 keV. Sixteen resonances of widths between 1 and 7 keV were observed in the Si-29(proton, gamma)P-30 reaction and 8 resonances in the Si29(proton, gamma)P-30 reaction. The resonances at 1324, 1748 and 1770 keV were found to be doublets. Author

N70-17224# Australian National Univ., Canberra. Research School of Physical Sciences.
ANGULAR DISTRIBUTIONS OF GAMMA RAYS FOLLOWING THE Ni-64(p,n gamma)Cu-64
W. F. Davidson, P. J. Dallimore, and J. Hellstroem [1969] 18 p refs
(ANU-P/473) Avail: CFSTI

Gamma ray angular distributions in the reaction Ni-64(proton, neutrongamma)Cu-64 were measured under conditions where the incident proton energies were close to the neutron threshold for the levels of interest. Using the theoretical predictions of the compound nucleus statistical model, unique spin assignments were obtained for the 159 keV (2+), 278 keV (2+) and 609 keV (2+) levels in Cu-64, and the most probable spins for the other levels were found to be 344 keV (1+), 362 keV (3+), 663 keV (1+), 739 keV (2+ or 3+), 746 keV (3+), 878 keV (1+ or 2+), 895 keV (3+) and 927 keV (1+). Multipole mixing ratios of the gamma rays observed were also obtained. Author

N70-17227# Australian National Univ., Canberra. Research School of Physical Sciences.
THE j-DEPENDENCE OF I EQUALS ONE TRANSITIONS IN THE Cr-54(d,p)Cr-55 REACTION
D. M. Rosalky, D. J. Baugh, J. Nurzynski, and B. A. Robson [1969] 21 p refs
(ANU-P/475) Avail: CFSTI

Differential cross sections for six l = 1 transitions in the reaction Cr-54(d,p)Cr-55 were measured at a deuteron bombarding energy of 8 MeV. The data have been described qualitatively by DWBA calculations employing spin–orbit terms in the deuteron and proton optical model potentials to reproduce the observed dependence on total angular momentum. Author

N70-17230# Australian National Univ., Canberra. Research School of Physical Sciences.
THE K-41(p,n)CA-41 GROUND STATE REACTION FROM THRESHOLD TO 1970 keV
G. U. Din and H. W. Lefevre (Oregon Univ.) [1969] 19 p refs
(ANU-P/463) Avail: CFSTI

The forward neutron yield was measured with 1 keV resolution from threshold at 1237.25 + or − 0.5 to 1440 keV, and with 2 keV resolution to 1970 keV. Average spacing of strongly excited 3− levels in Ca-42 at an excitation of 10.3 MeV is found to be 20 keV. On the basis of intensity a group of levels near E sub p = 1875 keV is proposed to be the T sub z = 1, T = 2 split Coulomb analog of a 3− state near 2390 keV in K-42. Author

N70-17250# International Centre for Theoretical Physics, Trieste (Italy).
DE SITTER SYMMETRIC FIELD THEORY. PART 3: QUANTIZATION IN WEINBERG'S BASIS
M. M. Bakri Sep. 1969 49 p refs Submitted for publication
(IC-69-114) Avail: CFSTI

The properties of the associated Green and causal functions are studied. Transformations of the Hilbert space under CPT and inhomogeneous Lorentz transformations are given. A simple closed expression is obtained for the Shaw–Weinberg matrix tensor. Author (ESRO)

N70-17268# California Univ., Berkeley. Dept. of Physics.
THE TWO-ELECTRON HOMOPOLAR MOLECULE: A TEST FOR SPIN- DENSITY- WAVES AND CHARGE- DENSITY-WAVES Technical Report
L. M. Falicov and Robert A. Harris Jun. 1969 27 p refs
(Contract Nonr-3656(30))
(AD-695523; TR-5) Avail: CFSTI CSCL 7/4

The eigenstates of the one-band Hamiltonian for a two-electron homopolar molecule can be exactly determined. The exact solution for the ground state and all its properties can thus be used as a standard to assess the accuracy and validity of several commonly used approximations: the normal molecular orbital ground state, the Heitler-London states, the spin-density-waves and the charge-density-waves. The most general unrestricted self-consistent field approximations are studied in both the Hartree and Hartree-Fock approximations, and compared with one another as well as with the exact results. New and simple correlated states are also proposed and tested: a symmetrized spin-density-wave and a symmetrized charge-density-wave. These new states are easily obtained from the corresponding Hartree-Fock states and, whenever they exist, they are extremely good approximations to the exact ground state. General consequences and extensions to more complicated systems can be inferred from this study. Author (TAB)

N70-17272# Institute for Nuclear Physics Research, Amsterdam (Netherlands).
FISSION OF N-13 [SPLITTING VAN N-13]
R. P. Kramer, A. H. M. Spaan, and Pj. Wippoo [1968] 89 p In DUTCH
(Rept-68/2) Avail: CFSTI

Semi-classical methods are used to analyze the reaction p + C-12 gives Li-6 + Be-7. It is shown that effective cross section energy peaks determine fragmentation; Q-values of the reaction agree with calculated Q-values for observed Li-6 and Be-7 energies. Since the observed particles leave each other at an angle of 180 deg it is shown that the portion of scattered Li-6 particles at a defined angle 0 equals the portion of detected Be-7 particles scattered at an angle (180 deg minus 0). The symmetry of 90 deg for the Stefan–Boltzmann constant of Li-6 indicates that the reaction takes part via the proton after its impact in the C-12 nucleus. Apparently the proton remains there for a brief time so that the development of the N-13 nucleus is "forgotten" and the outer shell of the nucleus does not assume a preferred orientation. Transl. by G.G.

N70-17273# Utah Univ., Salt Lake City.
THE CHARGE RATIO OF ULTRA-HIGH-ENERGY MUONS
J. H. Parker, J. W. Keuffel, H. E. Bergeson, M. O. Larson, and G. H. Lowe 1969 9 p refs Sponsored by NSF
Avail: CFSTI

Using the University of Utah neutrino detector, which has the advantage of observing relatively low energy muons with enormous energies at production, the charge ratio of muons with production energies greater than 1 TeV (a decade or − 0.05 for the lowest energy data point to 1.05 + or −0.14 for the highest. This introduces a constraint which any proposed muon production mechanism must satisfy. Author

N70-17280# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
NUCLEAR MAGNETIC RESONANCE IN VANADIUM CHROMIUM HYDRIDE
David Rohy and R. M. Cotts Sep. 1969 42 p refs
(Rept-1227) Avail: CFSTI

The Knight shift K and the spin-lattice relaxation time T1 of the nuclear magnetic resonance of V-51 are measured in the system V-Cr-H. Values of K sub V and (T sub 1) sub V in the binary systems V-Cr and VH are compared to present measurements in the ternary system using a rigid band model. Both K sub V and (T sub 1) sub V depend, to a good approximation, upon the electron per atom ratio of the alloy and are independent of relative concentrations of Cr and H. Data are consistent with the screened positive ion model for hydrogen in the metal in which the hydrogen atom contributes its electron to the conduction band of the system. No Knight shift of the H spins has been detected. Temperature dependence of T sub 1 for H was measured in several alloys. Author

N70-17291*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MIE SCATTERING: A COMPUTER PROGRAM AND AN ATLAS

Nadine A. Bicket and Gilmer A. Gary 29 Sep. 1969 104 p refs
(Contract NAS8-20166)
(NASA-TM-X-53951) Avail: CFSTI CSCL 20H

A brief background of Mie scattering is given, with applications in distributions of particles and effects of different lens apertures of the flux collecting device. A computer program, MIESCA, which calculates amplitude functions, efficiency factors, intensities, and polarizations, is listed, with adaptations for tape filing in the Univac 1108 and for plotting intensities and polarizations versus scattering angle on the SC 4020 plotter. An appendix on several numerical integrations and an atlas of scattering intensity graphs are included. Author

N70-17296*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTIVE RESONANCE INTEGRALS OF TANTALUM
Clarence R. Pierce, Donald F. Shook, and Donald Bogart Washington Jan. 1970 20 p refs
(NASA-TN-D-5628; E-5301) Avail: CFSTI CSCL 20H

Effective resonance integrals of tantalum were measured for a range of thickness varying from 0.000001 to 0.5 cm and were compared with resonance integrals calculated using the GAROL and the ZUT-TUZ codes. A value of 720 plus or minus 25 b was measured for the dilute resonance integral of tantalum, and it agrees with a calculated value of 730 plus or minus 35 b. The measured and calculated resonance integrals agree for most of the thickness range, with some evidence of discrepancy in the region of very thick samples. Resonance overlap effects were investigated and were calculated to be significant for very thick samples in both the unresolved and the resolved regions. When the overlap effect is taken into account, the agreement between measured and calculated resonance integrals is good for all values considered. Author

N70-17370# Japan Atomic Energy Research Inst., Ibaraki. Thermalization Group.
EVALUATION OF THERMAL NEUTRON SCATTERING CROSS SECTIONS FOR REACTOR MODERATORS
Sep. 1969 108 p refs
(JAERI-1181) Avail: CFSTI

A summary report of the evaluation work of thermal neutron scattering cross sections is presented. The report consists of three parts: general description, evaluation, and basic research works. The evaluation was aimed to be complete within the incoherent approximation. The studies and evaluations of the coherent effect, the multiple scattering correction, and other related problems are also included in the report as supplement. Author

N70-17415# Reactor Instituut, Delft (Netherlands).
GRAFT COPOLYMERS OF PAPER CELLULOSE PRODUCED BY IONIZING RADIATION
W. A. Cramer, J. P. W. Houtman, C. J. J. Ninck Blok, and D. Hogervorst 1969 16 p refs Presented at the Symp. on Util. of Large Radiation Sources and Accelerators in Ind. Process., Munich, 1969 Submitted for Publ.
(IRI-133-69-6; Conf-690805-5) Avail: CFSTI

Studies were made on the radioinduced graft polymerization of sheets of paper with various monomers, such as methyl methacrylate, acrylamide, methyl acrylate, acrylonitrile, and butyl acrylate using gamma rays at dose rates of about 0.1 and 10 Mrad/hr and with 1-MeV electrons at a dose rate of about 360 Mrad/hr. Graft polymers were produced by irradiation, either before adding monomers or in the presence of monomers. Wet and dry tensile strengths of the products were compared with those of untreated samples. It was concluded that a considerable increase in dry and wet strength can be obtained by radioinduced graft polymerization of sheets of paper. NSA

N70-17425# Institute of Nuclear Research, Warsaw (Poland).
DEPENDENCE OF THE ENERGY OF A NUCLEUS ON THE DEFORMATION
A. Sobiczewski 1968 57 p refs
(INR-1039) Avail: CFSTI

Results of investigations on the deformation dependence of the energy of nuclei, both in the ground and excited states, are discussed. Few regions of deformed nuclei are taken into account. Both stable and far off the stability line nuclei are considered. The problem of long-lived superheavy nuclei is discussed. Author (NSA)

N70-17430# Nihon Univ., Tokyo (Japan). Dept. of Physics and Atomic Energy Research.
NONLEPTONIC HYPERON DECAYS AND BREAKING OF DIRECT PRODUCT OF CHIRAL SU(3) AND SU(3)
Katsuhiko Ohya Oct. 1969 23 p refs Submitted for publication
(NUP-A-69-8) Avail: CFSTI

Nonleptonic decays of hyperons are discussed in connection with the breaking of chiral SU(3) $\otimes$ SU(3). The effective interaction of nonleptonic decays is assumed. The amplitudes of the decays are calculated in hard pion limit and give a good agreement with experiments both for S-waves and P-waves. In addition, it is shown that the f/d ratio of scalar spurion is −3.06, which is very close to that of mass-splitting −3.05, and lambda = 1.63. Therefore one may identify the mass operator, and then the strength of weak interaction is estimated. Author

N70-17433# Australian National Univ., Canberra. Research School of Physical Sciences.
ANALYSIS OF THE REACTION P-31(p,p SUB o) IN THE ENERGY RANGE 8.0 – 10.0 MeV
P. J. Dallimore and J. Hellstroem [1969] 23 p refs
(ANU-P/476) Avail: CFSTI

Absolute differential cross sections have been measured for the elastic scattering of protons from P-31. Excitation functions were measured for incident proton energies from 8.0 to 10.0 MeV in 10 keV steps at 14 angles and in 50 keV steps at 13 angles. The energy averaged angular distributions have been analyzed using the optical-model and Hauser-Feshbech theories and the excitation functions have been analyzed using the statistical theory of fluctuations. The fractions of direct reaction calculated by the two methods have been compared and are in good agreement for values of Y sub D > or = to 0.8. Author

N70-17441# Institute of Nuclear Research , Warsaw (Poland).
INTERNAL BREMSSTRAHLUNG ACCOMPANYING THE ELECTRON CAPTURE DECAY OF SM-145 [WEWNETRZNE PROMIENIOWANIE HAMOWANIA TOWARDYSZACE WYCHWYTOWI ELEKTRONOW ORBITALNYCH W ROZPADZIE SM-145]
Z. Sujkowski, B. Mysler, A. Zglinski, and B. Adamowicz 1968 8 p refs
(INR-1002) Avail: CFSTI

The internal bremsstrahlung IB effect in the decay of Sm-145 first forbidden, non-unique is studied. Stingles photon scintillation spectra are measured as well as the spectra in coincidence with the x-rays and the conversion electrons of the 61-keV gamma transition. The IB spectra due to the K capture and L + M + ... capture are analyzed separately. It is suggested that the shape of the L + M + ...IB spectrum differs from the theoretical one for allowed electron capture transition. Partial probabilities for the radiative K- and L + M + ...- radiative capture relative to that of the ordinary K caPture are determined. Author (NSA)

N70-17447# Central Electricity Generating Board, London (England). Research and Development Dept.
RESPONSE OF FINELY POWDERED THERMOLUMINESCENT LITHIUM FLUORIDE TO BETA RADIATION

J. R. Harvey and S. Townsend Jul. 1969 9 p refs
(RD/B/N-1312) Avail: CFSTI

Experiments are described on the response of thermoluminescent LiF crystals to beta radiation. Interpretation of the results of previous experiments with relatively large LiF crystals of around 100 micron dia was complicated because of penetration of beta radiation through air gaps between individual crystals. The effect of this penetration was eliminated in the experiments by the use of very small LiF crystals of 2 to 3 micron dia. The results indicate that the light output from thermoluminescence LiF is proportional to the energy absorbed from sources of beta radiation with end point energies in the range 0.167 MeV to 2.27 MeV. Author (NSA)

N70-17450# Institute of Nuclear Research, Warsaw (Poland).
EMISSION OF LIGHT NUCLEI IN THERMAL NEUTRON FISSION OF Pu-239
T. Krogulski, J. Chwaszczewska, M. Dakowski, E. Piasecki, M. Sowinski, and J. Tys 1968 24 p refs
(INR-1010) Avail: CFSTI

The relative intensities and energy spectra of H-1, H-2, H-3, He-4, He-6, and He-8 particles from the thermal neutron fission of Pu-239 have been measured. The comparison with the data relative to the spontaneous fission of Cf-235 and the thermal neutron fission of U-235 reveals a prominent similarity of the tripartition process irrespective of the fissioning nucleus. Author (NSA)

N70-17451# Institute of Nuclear Research, Warsaw (Poland).
THE (N,ALPHA) REACTIONS AND SOME PROBLEMS CONNECTED WITH THE DIRECT INTERACTIONS IN LOW-ENERGY REGION
Jan. Turkiewicz 1968 135 p In POLISH
(INR-970) Avail: CFSTI

Some results obtained in the experimental investigation of several nuclear reactions of the type (n,alpha) and (d,p) at low bombarding energies are presented. purpose of the investigation was to obtain some insight in the mechanism of the reactions studied and to get source informations concerning the structure of nuclei under investigation. Nuclear reactions (nalpha) were particularly used as a tool for investigation of the cluster structure of the surface of heavy nuclei. Author (NSA)

N70-17453# Chalmers Univ. of Technology, Goteborg (Sweden).
SPECTRA OF INTERACTING ELECTRONS IN METALS
Bengt I. Lundquist 1969 12 p refs
(NP-18018) Avail: CFSTI

A thesis summarizing seven papers, is presented on the important effects of the strong Coulomb interaction in metals. The Green function method is used to analyze the self-energy, and spectral weight functions are studied. Electron – plasmon coupling and plasmarons are also studied. NSA

N70-17467# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
A SURVEY OF THE ANGULAR DISTRIBUTION DATA ON N-P SCATTERING BELOW 10 MeV
T. Czibok 29 Jul. 1969 5 p refs
(KFKI-19/1969) Avail: CFSTI

A review is given of the angular distributions for n + p interactions at 2.5, 3.27, and 8.8 MeV. The data suggest the presence of a complex structure in the differential cross sections. NSA

N70-17472# Uppsala Univ. (Sweden).
INTERNAL CONVERSION STUDIES OF DOUBLE DECAY PROCESSES IN *In*-114
R. Vukanovic, L. Samuelsson, M. Migahed, L. Westerberg, and L. O. Edvardson Mar. 1969 5 p refs
(UUIP-629) Avail: AEC Depository Libraries

Concident events, which satisfy the energy conditions for double internal conversion, were observed for the 192-keV transition In-114 by extrapolating to a zero mass source. Author (NSA)

N70-17515# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONTRIBUTION TO THE SPECTROSCOPY OF 50 NEUTRON ISOTONES [CONTRIBUTION A LA SPECTROSCOPIE DES ISOTONES A 50 NEUTRONS]
Jean Picard (Ph.D. Thesis -Paris Univ., 27 May 1969) Jul. 1969 135 p refs In FRENCH; ENGLISH summary
(CEA-R-3856) Avail: CFSTI

Proton states in the isotones N = 50 have been studied through the reaction (He,d) on Sr, Zr, and Mo target nuclei with 18 MeV. The He projectiles as well as neutron hole states were investigated using the (He alpha) reaction on the same target. The information thus obtained on independent quasi-particle or hole states completes the set of experimental data required for a microscopic description of the collective properties of the even isotones Sr, Zr and Mo in the framework of BCS(IGW) + RPA theories. The results of this calculation are compared with experimental data and, more particularly, the results of 20 MeV proton inelastic scattering on Sr are analysed using antisymetrised DWBA with the microscopic wave functions calculated previously. Author (ESRO)

N70-17527*# Illinois Univ., Urbana.
SURFACE STUDIES
F. Propst, G. Ehrlich, G. Ayrault, J. Burkstrand, I. Cooper et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 1–46 refs (See N70-17526 06-34)
Avail: CFSTI CSCL 20H

Three experiments are described. They are electron impact desorption of ions and neutrals, energy angular distribution of secondary electrons, and high resolution electron spectroscopy of solid surfaces. A new activity in surface research was started emphasizing the study of the chemistry of the gas–solid interface. Author

N70-17548# Tokyo Univ. (Japan). Inst. for Solid State Physics.
NUCLEAR SPIN-SPIN EFFECT IN THE TOTAL CROSS SECTION FOR 1-MeV POLARIZED NEUTRONS ON POLARIZED Co-59 NUCLEI
Kanetada Nagamine, Akira Uchida, Akira Mikuni, Takenori Suzuki, Minoru Imaizumi et al Jul. 1969 59 p refs
(ISSP-A-371) Avail: CFSTI

Measurements of the spin–spin effect, sigma sub 55 in the total cross section for polarized neutrons on polarized Co-59 are reported at the neutron energies of 1.1 and 1.4 MeV. The degree of target polarization from 0.47 to 0.30 was obtained for a polycrystalline metal of Co(0.90) – Fe(0.10) alloy at demagnetization temperatures from 0.030 to 0.048 K. The results of sigma sub ss are –190 + or – 140 mb at 1.1 MeV and –180 + or – 180 mb at 1.4 MeV. If sigma sub ss is assumed to arise from a spin–spin term in the optical potential. The strength of the potential is 200 keV less than V sub ss less than 800 keV combining with the published data for sigma sub ss at 7.90 MeV assuming f(r) as a microscopic form factor. A weak and attractive nature of the spin–spin interaction is qualitatively explained by a microscopic model. Author (NSA)

N70-17548# Uppsala Univ. (Sweden). Inst. of Physics.
X-RAY EMISSION SPECTRA OF VC SUB X, NB C SUB X, Ta C SUB X, AND ZR C
Lars Ramqvist, (Axel Johnson Inst. for Ind. Res., Nynaeshamn, Swed.) Boerje Ekstig, Elisabeth Kaellne, Erik Noreland, and Rolf Manne Feb. 1969 23 p refs
(UUIP-620) Avail: CFSTI

X-ray emission spectra from carbides of V, Nb, Ta, and Zr were measured with the corresponding spectra of the pure elements. Comparisons were also made with electron spectroscopy

measurements, and with earlier reported metal and carbon soft X-ray spectra. In all the carbides investigated, the shift measurements and the metal band spectra confirm the positive character of the metal atom. NSA

N70-17549# Brookhaven National Lab., Upton, N.Y. Information Div.

GAMMA-RAY SPECTRUM FROM RADIATIVE CAPTURE IN Cs

F. Becvar, J. Vrzal, J. Liptak, and J. Urbanec Jul. 1969 14 p refs Transl. into ENGLISH from Czech. J. Phys. (Prague), no. 19, 1969 p 248–253

(BNL-tr-284) Avail: CFSTI

The measurements of the gamma-ray spectra following resonance neutron capture in Cs-133, performed with the aid of a Ge(Li) detector with an active volume of about 12 cu cm, are described. The energies and intensities of a number of transitions were obtained. Author (NSA)

N70-17560# Scientific Translation Service, Ann Arbor, Mich.

WEIGHTING AND BIASING OF A MONTE CARLO CALCULATION FOR VERY DEEP PENETRATIONS

Jeanne-Marie Lanore [1969] 17 p refs Transl. into ENGLISH of CEA, Centre d'Etudes Nucl. report Prepared for ORNL

(ORNL-tr-2213) Avail: CFSTI

From the solution of the adjoint to the transport equation, a weighting and biasing system is developed permitting one to obtain a constant variance in every point of the phase space which is strict in a particular case and nearly strict in the general case by means of the Monte Carlo method. Neutron spectra at a very great distance from the source are then derived with accuracy. Author (NSA)

N70-17562# Comitato Nazionale per L'Energia Nucleare, Rome (Italy).

TWO-LEVEL RESONANCE FORMULAS AND THEIR APPLICATION OF THE EFFECTIVE RESONANCE INTEGRAL

E. Menapace et al 1968 31 p refs Transl. into ENGLISH of Italian Report PVR-r-68(16) Sponsored by US-Euratom

(Contract EURATOM-017-66-7-RAPI)

(EURFNR-638; PRV-r-(68)16) Avail: CFSTI

An expression is developed which gives the cross-section curve when two resonances are near, so that allowance must be made for positive and negative interference effects. In general, the use of multi-level formulas is suggested for situations in which the distance between the resonances is comparable with their width, as occurs with U-233 and Pu-239 fissile isotopes, for instance. The significant cases considered are those which represent situations of maximum positive or negative interference. The cross sections for such cases are then used to evaluate the effective resonance integral. Finally, a description is given of the Fortran RESON code written for the IBM-7094 digital computer, which uses the formulas found to carry out this type of calculation. The code includes a subroutine (MOLDES) which calculates the two-level cross section, widened by the Doppler effect, as a function of temperature. Author (NSA)

N70-17558# Eidgenoessiches Institut fuer Raktorforschung, Wurenlingen (Switzerland).

DISTRIBUTION OF MASS AND CHARGE IN THE FISSION OF TH-227

K. F. Flynn and H. R. von Gunten Jun. 1968 18 p refs Presented at the 2nd Conf. on Phys. and Chem. of Fission, Vienna, 28 Jul. – 1 Aug. 1969 Sponsored in part by Swiss Natl. Sci. Found.

(EIR-157; CONF-690708-3) Avail: CFSTI

The distribution of mass and charge in the thermal-neutron-induced fission of Th-227 was investigated by radiochemical determination of the fission yields of 29 mass chains and one shielded nuclide (independent yield). The yields were determined relative to the known yields for U-235 fission and normalized to absolute values by summation to 200% total fission yield. The mass distributiop is asymmetric; the heavy-mass group is centered at about the same position as in all previously investigated cases of low-energy fission, while the light-mass group is shifted to a lower mass number. The peak half width (full width at half maximum) is 11.5 mass units, and the full width at one tenth maximum is 19 mass units. All these values fall well on systematic plots for the positions of the peaks and for the widths of mass distributions for various fissionable nuclides. Author (NSA)

N70-17560# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).

POSTIRRADIATION EXAMINATION OF THE FIRST TEST ELEMENT 2 IRRADIATED IN THE LUCENS REACTOR [EXAMENS POSTIRRADIATOIRES DU PREMIER ELEMENT TEST 2 IRRADIE DANS LE REACTEUR DE LUCENS]

M. Stauffer Mar. 1969 29 p In FRENCH

(EIR-151) Avail: CFSTI

The test element II was disassembled and subjected to various post-irradiation examinations. These examinations showed that the test element behaved extremely well under irradiation. Its relatively low burn-up rate did not provoke significant material modifications. The uranium alloy was expanded perceptibly, but the cladding magnesium was almost unaffected. The Zircaloy-2 maintained its properties of elasticity and resistance, and the graphite was modified only to improve its permeability. Author (NSA)

N70-17571# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE STUDY OF THERMAL DIFFUSION IN ISOTOPIC MIXTURES OF HYDROGEN [CONTRIBUTION A L'ETUDE DE LA DIFFUSION THERMIQUE DANS LES MELANGES ISOTOPIQUES DE L HYDROGENE]

Annick Lamarechal-Dupuis (Ph.D. Thesis - Paris Univ., 18 Apr. 1968) Oct. 1969 84 p refs In FRENCH; ENGLISH summary

(CEA-R-3538) Avail: CFSTI

The thermal diffusion constants of the mixtures H2HD and H2HT, where HD and HT were at trace concentrations, were measured between 90 K and 450 K for H2-HD and between 190 K anf 450 K for H2HT, by using the elementary effect. Furthermore, the ratio of these constants was measured by using a thermogravitational column at hot wire temperatures between 455 K and 1200 K, the cold wall being at room temperature. Comparison with the predictions of existing theories shows that the Chapman-Enskog theory cannot account for the thermal diffusion of mixtures containing asymmetric molecules and possible reasons for this disagreement are discussed. These measurements, combined with other results, yield precise values under well defined conditions of temperature and concentration and are useful for the determination of coefficients of a certain semi-empirical expansion. Author (ESRO)

N70-17574# International Centre for Theoretical Physics, Trieste (Italy).

LINEAR RISING TRAJECTORIES IN THE TIME DELAY ANALYSIS OF THE SCATTERING AMPLITUDE

G. Cocho and A. Mondragon Sep. 1969 35 p refs Submitted for publication

(IC-69-112) Avail: CFSTI

It is explicitly shown that the integration parameter in the background Regge integral can be understood as a time delay variable, its average value being the time delay and distortion caused on a wave packet by a scatterer, as seen in the Breit system of coordinates. By means of the usual exponential Fourier transform, another time delay variable is defined with a similar meaning for the scattering process as seen in the laboratory system of coordinates. A parameterization of the scattering amplitudes in the time delay representation is proposed, valid at high and intermediate energies. It is pointed out that the non-spin-flip pion-nucleon

scattering amplitudes are consistent with such a parametrization. An interpretation of models with linear rising trajectories in terms of multiscattering processes seems natural in the time delay representation. Author (ESRO)

N70-17593# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre D'Etudes Nucleaires.
CHANNELLING PATTERNS IN METALLIC CRYSTALS [ETUDES DES FIGURES DE CANALISATION DANS LES CRISTAUX METALLIQUES]
Jean-Claude Jousset, Jean Mory, and Jean-Jacques Quillico [1969] 10 p refs In FRENCH; ENGLISH summary Presented at Intern. Meeting on the Study of Charged Particle Tracks in Solid Insulators and Their Appl., Clermont-Ferrand, France, 6-9 May 1969 (CEA-CONF-1318; CONF-690522-2) Avail: CFSTI

Channelling in crystals has been studied using the possibility of recording alpha particles in cellulose nitrate. These alpha particles are isotropically emitted by an americium-241 source. A thin foil of the metal in study (polycrystal) is set on the source. The channelled particles are recorded in a foil of cellulose nitrate. Many applications of this method are available in metallurgy like metallographic studies or defects studies in irradiated crystals. Some geometric features appear frequently in these canaligraphies. Their geometry (triangles, crosses) can be related to the crystallographic texture of the sample. These patterns are made by the numerous impacts, on the cellulose nitrate, of those alpha particles which go through the crystal by planar channelling. Some low temperature studies of these geometrical patterns show that cellulose nitrate is able to record under vacuum the tracks of alpha particles at temperatures as low as 4.2 K. Author (NSA)

N70-17595# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
AVERAGE FISSION CROSS SECTIONS AND RESONANCE INTEGRAL CONTRIBUTIONS BETWEEN 10 eV AND 20 keV DEDUCED FROM SCISRS DATA TAPES
G. D. James and M. G. Schomberg 1969 16 p refs Revised
(AERE-M-2157-Rev) Avail: CFSTI; HMSO 2s 6d; BIS $0.60

Data tapes listing the experimental fission cross section data below 35 keV from the SCISRS data file were obtained and used to determine the average fission cross section and resonance integral contributions over selected energy ranges from 10 eV to 20 keV. These results are presented in tabular form. The causes of the discrepancies noted earlier were investigated. It is suggested that the information in each data set could be used to generate a single number which could be used by each user to confirm that the data set is correct. Author (NSA)

N70-17596# Ceskoslovenska Akademie Ved, Rez.
RELATIVISTIC KINEMATICS IN NUCLEAR REACTIONS [RELATIVISTICKA KINEMATIKA VJADERNYCH REAKCICH]
J. Rikovska and V. Kroha Oct. 1968 50 p refs In Czechoslovakian
(UJV-2067-F) Avail: AEC Depository Libraries

Results of measurements of nuclear reactions and those involving elementary particles must be subjected to kinematic analysis. This requires a determination of the correlation between the angular distribution of the emitted particles and their energies and a comparison of the data with theoretical predictions. The relativistic kinematics of and fundamental reactions with two products in the output channel are summarized. Studies were also carried out on the determination of the optimum position of the target in order to minimize the energy scatter of the reaction products. The results were analyzed by means of a special computer program. Soviet papers on the kinematics of nuclear reactions are listed. NSA

N70-17598# Ceskoslovenska Akademie Ved, Rez.
FLUCTUATION OF PARTIAL RADIATION WIDTHS FROM RESONANCE NEUTRON CAPTURE IN THE Pr-141 NUCLEUS
F. Becvar, S. A. Telezhnikov, J. Pospisil, J. Urbanec, and J. Vrzal Jul. 1969 10 p refs
(UJV-2228-R) Avail: CFSTI

A statistical analysis of the fluctuations of the partial radiative widths from resonance neutron capture in Pr-141 was performed. The partial widths were reduced to the energy dependence in E3 and to the relative level density spin dependence. The number of degrees of freedom in the Porter–Thomas distribution was made for a statistical sample from experimental data by the maximum likelihood method. The large number of degrees of freedom obtained for 3+ resonances suggests that pronounced nuclear structure effects appear in Pr-142 and that the statistical model is not fully adequate in this case. NSA

N70-17605*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
A PROPOSED METHOD FOR REGENERATION OF NEUTRON PRODUCING TARGETS, WITHIN AN ACCELERATOR, BY ION SPUTTERING TECHNIQUES
Donald L. Alger and Robert Steinberg Washington, D.C. Jan. 1970 24 p refs
(NASA-TN-D-5598; E-5073) Avail: CFSTI CSCL 20H

A proposed sputtering electrode system design is presented that makes possible regeneration of targets within an accelerator. The formation of a tritide target from an applied titanium film is also discussed. The design of an X-ray fluorescence detector for measuring the thickness of material deposited or removed from the target is suggested. Finally, titanium and titanium deuteride etch rates are presented as obtained by a sputter electrode system mockup for a rotating target assembly under development. Author

N70-17614# Princeton Univ., N.J. Palmer Physical Lab.
SEARCH FOR THE PROCESS ELECTRON PLUS ELECTRON YIELDS TWO NEGATIVE MUONS
David C. Cheng (PH.D. Thesis) 1 May 1969 102 p refs
(Contracts Nonr-1858(39); AT(30-1)-2098; AT(04-3)-515)
(AD-696698) Avail: CFSTI CSCL 20/8

In order to make a sensitive test of whether a multiplicative or an additive lepton number conservation law is at work in leptonic reactions, the process (electron + electron yields two negative muons) was searched for using colliding beams. The result of the experiment sets an upper limit on the cross-section of 0.8 x (10 to the minus 32 power) cm squared. A phenomenological Hamiltonian describing a point interaction of strength G can be introduced for the process. Author (TAB)

N70-17623*# Field Emission Corp., McMinnville, Oreg.
TOTAL ENERGY DISTRIBUTION MEASUREMENTS OF FIELD EMITTED ELECTRONS Progress Report, 15 May - 15 Sep. 1969
L. W. Swanson and L. C. Crouser Nov. 1969 14 p refs
(Contract NASw-1516)
(NASA-CR-107843; PR-11) Avail: CFSTI CSCL 20H

Effects of band structure on total energy distribution (TED) measurements of field emitted electrons from rhenium are explored. Specific perturbations observed on TED measurements along certain crystallographic directions are explained with specific references to the bulk electronic band structure. A rhenium emitter was examined both in a (1010) direction with a magnetic type deflection tube and in a (0001) direction with an electrostatic deflection quadrupole tube. Calculated intersections of the Fermi surface with the symmetry planes of the Brillouin zone are shown for the hexagonal crystal structure along with TED plots. J.M.

N70-17625*# Field Emission Corp., McMinnville, Oreg.
TOTAL ENERGY DISTRIBUTION MEASUREMENTS OF FIELD EMITTED Progress Report, 15 Feb. - 15 May 1969
L. W. Swanson and L. C. Crouser Aug. 1969 46 p
(Contract NASw-1516)
(NASA-CR-107858; PR-10) Avail: CFSTI CSCL 20H

Additional total energy distribution (TED) measurements of vacuum field emitted electrons were obtained to understand the cause of the structure observed on the TED when polyatomic molecules are absorbed at the surface. The perturbation of the electronic and/or vibronic levels of the adsorbate by the adsorption act and illucidation of certain aspects of surface catalytic mechanisms in the chemisorption process were studied using pentacene adsorbed on the (310) plane of tungsten. Further results using phthalocyanine absorbed on molybdenum and tungsten are interpreted. Both phthalocyanine and pentacene greatly alter the TED structure of tungsten and molybdenum. A study of the temperature, shape, and field dependence of the TED curves suggests that both electron-electron and electron--phonon interactions are involved. Elastic tunnel resonance could not be ruled out as a possible mechanism in some results. J.M.

N70-17629# C-E-I-R, Ltd., London (England).
THE THIRD PHASE OF RESEARCH ON ATOMIC STRUCTURES Final Report
D. F. Mayers and F. O'Brien Sep. 1969 548 p refs
(Contract AF 33(615)-5203)
(AD-697049; ARL-69-0139) Avail: CFSTI CSCL 7/4

The theoretical basis for methods of solving the Hartree-Fock equations with configuration interaction, and the relativistic Hartree-Fock equations, are presented. Complete descriptions of programs to solve these equations are included. Author (TAB)

N70-17639# Ceskoslovenska Academie Ved, Rez. Ustav Jaderneho Vyzkumu.
RADIOCHEMICAL ISOLATIONS OF SOME NEUTRON-DEFICIENT ISOTOPES OF OSMIUM AND MERCURY
M. Vobecky and M. Fiser Jul. 1969 21 p refs
(UJV-2204-CH) Avail: CFSTI

The isolation of carrier-free neutron-deficient activities of osmium (Os-182, Os-183, Os-185) and Mercury (Hg-192, Hg-193m+193, Hg-194, Hg-195m+195, Hg-203) and preparation of sources for measurement of conversion electron spectra are discussed. The preparation of osmium is based on distillation from nizric acid medium and extraction of distillate by tetrachloromethane. Mercury was extracted as a dithizonate complex from a mineral acid-EDTA-sulphite medium. The carrier-free activities of platinum, thallium, yttrium, thulium, ytterbium, and lutetium were also isolated and identified from the mixture of spallation products of lead. Author (NSA)

N70-17641# TRI-Univ. Meson Facility, Vancouver (British Columbia).
PROGRAM TO CALCULATE THE PHASE SPACE ACCEPTANCE OF A BEAM HANDLING SYSTEM: THEORY AND PRELIMINARY RESULTS
R. W. Harrison (Victoria Univ., British Columbia) and D. E. Lobb (Victoria Univ., British Columbia) Oct. 1968 67 p refs
(TRI-68-7) Avail: CFSTI

A computer program to determine the phase space acceptance of a beam transport system consisting of drift lengths, quadrupoles, and $n = 0$ bending magnets is described. It uses a technique which involves tracking trajectories obtained by a polar coordinate search pattern in initial phase space. The 3×3 first order matrix formulation of Penner is used with the horizontal (x,x prime) and vertical (y,y prime) phase planes treated separately. This simplifies the calculations and interpretation but means that the treatment may be used only in the case of rectangular apertures. Examples are given to show the dependence of the acceptance upon system length, aperture, element spacing within the system, and particle energy. This program was written in Fortran IV for the IBM 360/44. Author (NSA)

N70-17645# TRI-Univ. Meson Facility, Vancouver (British Columbia).
PRELIMINARY DESIGN OF TRANSPORT SYSTEMS FOR TRIUMF BEAM LINE 1
Maurice F. Tautz (Victoria Univ., British Columbia) Oct. 1968 41 p refs
(TRI-68-8) Avail: CFSTI

The design characteristics of a beam transport system for beam line I of the proposed TRIUMF isochronous cyclotron are described. It is shown that the beam is to undergo dispersionless extraction and then to be focused on up to three pion production targets located along the beam line before the neutron facility. The first target will be a distance of about 15 to 20 meters from the accelerator exit. The transmitted beam is again focused on the second pion production target approximately 13 meters away and then on the third target situated about another 13 meters down the beam line. The systems have been designed to accommodate thin targets at 1 and 2 and either thin or thick targets at 3. Finally, this beam, which will have a large emittance due to its interaction with the targets, must be transported to the neutron irradiation facility. NSA

N70-17646# Atomic Energy of Canada, Ltd., Chalk River, (Ontario). Nuclear Labs.
SHIELDING AND ACTIVATION IN A 500 MeV H(−) CYCLOTRON FACILITY
I. M. Thorson Vancouver, British Columbia TRI-Univ. Meson Facility Dec. 1968 65 p refs Prepared in cooperation with TRI-Univ. Meson Facility
(TRI-68-4) Avail: CFSTI

The shielding required for the residual activity produced in the Tri-University Meson Facility (TRIUMF) are discussed. The facility is based on a 500 MeV H(−) isochronous cyclotron capable of accelerating 100 microamps of beam current. The 10 kW of beam power lost in the cyclotron by electromagnetic dissociation of the negative hydrogen ions will rpoduce residual radiation fields in the cyclotron of the order of 1 Rem/hr a few hours after shutdown following a long operating period. The estimated shielding required around the periphery of the cyclotron to achieve radiation fields of 2.7 mRem/hr at full power is approximately 9 m of concrete. The primary beam dump designed for use as a neutron irradiation facility can produce a useful neutron flux in the graphite moderator surrounding a 10 cm diameter lead or bismuth target. Author

N70-17647# TRI-Univ. Meson Facility, Vancouver (British Columbia).
ELECTRIC DISSOCIATION OF HYDROGEN IONS BY MAGNETIC FIELDS
G. M. Stinson (Alberta Univ., Edmonton), W. C. Olsen (Alberta Univ., Edmonton), W. J. McDonald (Alberta Univ., Edmonton), D. Axen (British Columbia Univ.), and E. W. Blackmore (Gt. Brit. Natl. Inst. for Res. in Nuclear) May 1969 32 p refs
(TRI-69-1) Avail: CFSTI

Electric $V \times B$ dissociation of H(−) ions moving through a magnetic field has been measured for electric field strengths near 2 MV/cm. The H(−) ions were obtained by charge exchange of protons in water vapor and were accelerated to 49.5 MeV by proton linear accelerator at the Rutherford High Energy Laboratory. Stripped particles were detected using an acoustic spark-chamber. Experimental lifetimes are slower by approximately a factor of two from those predicted by Mullen and a factor of three from those predicted by Hiskes. Measurements also appear inconsistent with those of Cahill et al. Author (NSA)

N70-17650# Atomic Energy Establishment, Winfrith (England).
EVALUATION OF THE NEUTRON CROSS-SECTION DATA FOR ZIRCONIUM AND ITS STABLE ISOTOPES IN THE RESOLVED RESONANCE RANGE
J. S. Story and A. L. Pope Jul. 1969 33 p refs
(AEEW-M-921) Avail: CFSTI

A new evaluation is presented of the resonance neutron cross sections for natural zirconium and its stable isotopes, with a view to compiling a file of basic tabulated neutron cross-section data. Particular attention has been given to evaluation of the

radiation widths for s-wave interactions. Where possible, they have also been derived from measured isotopic resonance integrals or thermal neutron cross-section data. The resolved resonance region for the natural element up to 6 keV is represented. The resonance absortpion integral for dilute natural zirconium appears to be known to about + or − 10% or 15%. It is noted that: (1) the measured values of the thermal neutron capture cross-sections of the isotopes are not consistent with the data for natural zirconium; in particular, the value for Zr-91 appears to be too high by nearly a factor of 2; (2) there is a need for measurements of the radiation widths of all the even isotopes of zirconium. Author (NSA)

N70-17684 Pennsylvania Univ., Philadelphia.
RE-ENTRY BOUNDARY LAYERS WITH ELECTRON NONEQUILIBRIUM
Doyle Darwin Knight (Ph. D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-5636

Electrons in the ionized boundary layer on a cold body may have a temperature considerably higher than the temperature of the heavier species. Analyses which were made to evaluate the influence of ionization on heat transfer all were made with the electron and heavy particle temperatures assumed equal. The purpose is to study the electron heat transfer in reentry boundary layers including electron thermal and chemical nonequilibrium and also including electrical current to the body, and finite surface catalycity (for charged particles). Degree of ionization is from .3% to 4.3% corresponding to electron concentrations 0.88 to 13.8 × 10 to the 16th power 1/cm cu. Electron-ion recombination is important in such cases with the boundary layer residence time being greater than ten times a characteristic reaction time so previous work for these conditions assumed ionization equilibrium as well as thermal equilibrium. Dissert. Abstr.

N70-17686 Florida Univ., Gainesville.
ANALYSIS OF LOW ENERGY ATOMIC AND MOLECULAR COLLISIONS: SEMICLASSICAL ELASTIC SCATTERING CALCULATIONS AND DECONVOLUTION OF DATA
George Elias Ioup (Ph.D. Thesis) 1968 343 p
Avail: Univ. Microfilms: HC $15.55/Microfilm $4.40 Order No. 69-5391

The levels of approximation which may be used in the calculation of elastic differential scattering cross sections for known central force interaction potentials are given. Included are the quantum partial wave formulas, the semiquantal summation procedure, semiclassical methods, and classical results. The range of validity of each is discussed. Special attention is given the semiclassical treatment, which is the main topic. The need for the accurate evaluation of derivatives of the classical deflection function is established. The derivations of integral expressions for the second and third derivatives of the classical deflection function are given. Also presented is essential information for the rapid and precise determination of these derivatives by numerical quadrature on a digital computer. Transformations of integrals to facilitate this evaluation are included. Dissert. Abstr.

N70-17686# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
A COMPUTER (GIER-ALGOL) PROGRAM FOR COMPUTING ELECTRON AND POSITRON WAVE FUNCTIONS
M. Vinduska Jul. 1969 30 p refs
(UJV-2184-F) Avail: CFSTI

The Algol program for computing electron and positron wave functions with phases is presented. The comparison with previous results is given. Author (NSA)

N70-17688# United Kingdom Atomic Energy Authority, Harwell (England).
THE HALF-LIFE OF Au-198 AND THE MEASUREMENT OF HALF-LIVES BY GAMMA-RAY SPECTROMETRY
M. J. Cabell and M. Wilkins Jun. 1969 46 p refs
(AERE-R-6063) Avail: CFSTI

The half-life of Au-198 was measured by observing the rate of decay of the photopeak produced by its 0.412 MeV gamma-ray in a sodium iodide scintillation detector. The crude spectral data were analyzed using five different statistical models. In the first four of these the common method of fitting a straight line to the logarithm of the decay curve was employed. Either the height or the area of the photopeak was chosen as the observed variable, and the squares of the residuals were either unweighted, or weighted proportionally to the reciprocals of the variances of the observed variable, to obtain the best fit. The results from these analyses were found to depend on the period of time during which the decay data were accumulated. Moreover, it is known that the linear transformation may lead to biased results. In the fifth method of analysis the areas of the photopeaks were fitted to an untransformed exponential decay curve, the squares of the residuals being weighted proportionally to the reciprocals of the variances of the areas produced by the fit. It is known that this method yields unbiased results provided the decay data are accumulated over three half-lives or more. Author (NSA)

N70-17689# United Kingdom Atomic Energy Authority, Harwell (England).
STABLE ISOTOPES: SALES AND LOANS OF ISOTOPIC SAMPLES, NUCLEAR TARGETS, ISOTOPIC FOILS, AND MOESSBAUER ADSORBERS
1968 28 p refs
(NP-18012) Avail: CFSTI

The elements and isotopes stocked and their chemical form, abundance, and price are listed. Also, information on the targets which can be supplied are listed, including preparation method, weight limit, chemical form, and type of backing. The AERE loan service for isotope samples and certain targets is described. NSA

N70-17716# Commissariat a l' Energie Atomique, Cadarache (France).
MEASUREMENTS OF SOME PHYSICAL PARAMETERS RELATED TO RAPSODIE'S IRRADIATION EXPERIMENTS
J. Gourdon, M. Besoux, and J. De Goer [1968] 29 p refs
Held at The Intern. Conf. on Fast Reactor Irradiation Testing, Thurso, Scotland, 14-19 Apr. 1969
(CEA-CONF-1321; CONF-690427-1) Avail: CFSTI

Physics measurements for irradiation experiments in Cadarache Reactors (Rapsodie) are presented. Techniques required to obtain the measurements are described. The measurements include: fission rates; subassembly outlet temperatures; gamma heating; and dosimetry. NSA

N70-17717# Commissariat a l'Engerie Atomique, Saclay (France).
O-16 STATES FROM THE C-13(Li,t) O-16 REACTION AT 20 MeV
G. Bassani, N. Saunier, B. M. Traore, and T. H. Kruse (Rutgers Univ.) 1969 1 p Presented at the Intern. Conf. on Properties of Nucl. States, Montreal, 25 – 30 Aug. 1969 Prepared in cooperation with Rutgers Univ.
(CEA-Conf-1326; Conf-690804-2) Avail: CFSTI

The energy spectra and angular distribution of tritons in the reaction C-13(Li-6,t)O-16 at 20 MeV are reported. The energy levels of O-16 including a possible new one, are examined. Author (NSA)

N70-17759 Texas Univ., Austin.
MOESSBAUER STUDIES OF SOME IRON (-II) TETRAHEDRAL COMPOUNDS
Richard Allan Mazak (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-6183

Predictions are made about the Mossbauer spectra expected of iron (-II) tetrahedral compounds by utilizing the approach of crystal field theory. The compounds are conveniently categorized

into FeA2B2, FeA3B, and FeA2BC cases where the upper case letters are utilized to represent the various ligands which are attached to the iron atom and their respective values. It is concluded that the Mossbauer spectra of these compounds will be mainly dependent on the ligands attached. The reason for this is that the iron 3d electronic shell will be completely filled and hence spherically symmetric. Spherically symmetric charge distributions do not cause a quadrupole splitting. Any quadrupole splitting will be caused by a difference in the values for the ligands involved. It is predicted that apart from distortions the quadrupole splitting for the FeA2B2 case will be approximately 11% larger than that of the FeA2B2 case where identical ligands are involved. Dissert. Abstr.

N70-17785# Roorkee Univ. (India). Dept. of Physics.
PHASE TRANSITION DETECTORS AND LIQUID STRUCTURE
N. C. Varshneya *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 96–100 (See N79-17766 06-29)
Avail: AEC Depository Libraries

The phenomena of supercooling in liquids and of supersaturation in vapors are considered. These critical phenomena represent a metastable state and the homogeneous nucleation in these states occurs by chance probability. Calculating the free energy for supersaturated vapors and supercooled liquids indicates that the energy transitions are quantized. In homogeneous nucleation only those clusters begin to grow which are crystalline for a particular moment and which have been brought to a certain peak level at that moment. Experiments are also described for enhancing the condensation process of vapors by application of an electric field. R.B.

N70-17826# Tata Inst. of Fundamental Research, Bombay (India).
PARTICLE PHYSICS: A SURVEY (REVIEW)
Virendra Singh *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 370–397 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Briefly discussed are the following aspects of particle physics: (1) CP violation; (2) SU(3) symmetry; (3) SU(6) symmetry and its relative generalizations; and (4) S-matrix dynamics. Detailed new developments described pertain to current algebra and soft pion physics, high energy phenomenology and Regge poles, and sum rules. Author

N70-17827# Delhi Univ. (India). Centre for Advanced Study in Physics.
STATUS OF C, P, T (REVIEW)
S. N. Biswas *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 398–411 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Experimental tests are described for determining the discrete symmetry operations of C, P, and T in various particle interactions. CPT symmetry (the combined operation of C, P, and T) tests properties which are independent of the detailed assumptions about the nature of the interactions except for their being Lorentz-invariant, local, or Hermitian. Continuous space-time symmetry, which is the consequence of the invariance of the Hamiltonian under the inhomogeneous Lorentz group without reference to a specific interaction, also holds better than C, P, or T separately. R.P.

N70-17828# Tata Inst. of Fundamental Research, Bombay (India).
SYMMETRIES AND BROKEN-SYMMETRIES IN PARTICLE PHYSICS (REVIEW)
L. K. Pandit *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 412–435 (See N70-17766 06-29)
Avail: AEC Depository Libraries

A review is presented of the various symmetries which make the physical behavior of the most complicated system tractable even without detailed computations. Under a transformation of the variables describing the physical system in question, the relevant dynamical equations are invariant. Since it is the Hamiltonian that describes the dynamical behavior both in classical and quantum physics, the canonical transformations under which the system is invariant need only be specified. The mathematical objects that generate these transformations must represent conserved physical quantities. Conversely, the existence of the conserved physical quantities imply the corresponding invariances or symmetries of the Hamiltonian. Consideration of any symmetries in particle physics requires that the generators of a symmetry transformation commute with the Hamiltonian of the system. R.B.

N70-17829# Tata Inst. of Fundamental Research, Bombay (India).
LIMITS OF QUANTUM ELECTRODYNAMICS (REVIEW)
B. M. Udgaonkar *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 436-458 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Quantum electrodynamics is defined as the theory of the interaction between electromagnetic radiation and charged particles. The charged particles include only the electron and the muon, because all the other charged particles participate in strong interactions, which are not well understood, and whose effects cannot be separated from the purely electromagnetic interactions. High and low energy experiments are described for testing the limits of QED. The high energy experiments are designed to reveal relatively large discrepancies and the low energy experiments attempt to improve the accuracy of experimental measurements and to take small terms into account in the theoretical calculations in order to reveal any possible small deviations. R.G.

N70-17830# Saha Inst. of Nuclear Physics, Calcutta (India).
SCHWINGER TERMS
T. Pradhan *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 459–472 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

The matrix elements of equal time current commutators are indeterminate due to the singular nature of local relativistic quantum field theory. The ambiguity can be eliminated by either a regularization or non-relativisitic cut-off prescription. According to the latter, equal time current commutators have derivative delta functions in addition to the usual delta function term, while in the regularization prescription these terms are removed. The derivative delta functions are called Schwinger terms. If such terms exist and their coefficient are C-numbers, Jacobi identity is not fulfilled unless there are additional q-number coefficient terms of this category. Because of these terms matrix elements of time ordered products of current operators are not covariant quantities. These terms destroy the gauge invariance of conventional field theory, and redefinition of matrix elements is necessary to ensure gauge invariance. In some cases the terms correspond to disconnected diagrams, but they do not contribute to matrix elements of physical processes in the infinite momentum limit. They can be ignored in the derivation of sum rules at infinite momentum and they do not occur in commutators of integrated currents. Author

N70-17831# Tata Inst. of Fundamental Research, Bombay (India).
SPECTRAL FUNCTION SUM RULES
P. P. Divakaran *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 473–485 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

A selective review is presented of recent work on spectral function sum rules. The spectral functions occurring in vacuum current-correlation functions are investigated and the applications of the sum rules are extended to special cases such as SU(3) symmetry and electromagnetic mass differences. R.B.

N70-17832# Indian Inst. of Tech., Kanpur. Dept. of Physics.
BROKEN SYMMETRIES AND GOLD STONE THEORY
Tulsi Dass *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys., 6 Apr. 1968 p 486–492 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

The spontaneous breakdown of symmetries is applied, in which a Lagrangian of Hamiltonian invariant is used under a continuous symmetry group and equations of motion are solved which have less symmetry than that present in the Lagrangian. In order for the symmetry in the Lagrangian to manifest itself fully in the dynamics, it is necessary to assume that generators of the symmetry annihilate the vacuum. The spontaneous breakdown of symmetries is usually formulated by assuming nonzero vacuum expectation values of some definite scalar fields. Consistent formulation of such a pattern of symmetry breakdown in a covariant framework always requires the existence of zero mass bosons in the particle spectrum. Using Lagrangian invariance, a simple proof of the Goldstone theorem is outlined. R.B.

N70-17833# Saha Inst. of Nuclear Physics, Calcutta (India).
COMPLEX ANGULAR MOMENTUM PLANE
H. Banerjee *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys., 6 Apr. 1968 p 493–506 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

The Regge phenomenology of high energy scattering is discussed. Within the framework of Regge formalism, dips or sharp minima in the angular distribution of different reaction processes are attributed to the zeros of the residue functions in the Regge pole terms, which follow from the requirements of Mandelstam analyticity. The various problems encountered in unequal mass scattering are outlined. R.B.

N70-17834# Tata Inst. of Fundamental Research, Bombay (India).
RADIATIVE CORRECTIONS TO beta DECAY
G. Rajasekaran *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys., 6 Apr. 1968 p 507–520 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

In calling the vector coupling constant for Delta S = 0 hadronic beta decay and the muon decay coupling constant G sub v and G sub mu, respectively, the question is posed whether G sub v is equal to G sub mu or whether it is equal to G sub mu cos theta. Recent results of current algebra are applied in calculating the electromagnetic radiative corrections to beta and muon decays. R.B.

N70-17835# Tata Inst. of Fundamental Research, Bombay (India).
Y (1405) AS A POSSIBLE EXCEPTION TO THE QUARK-PICTURE OF HADRONS
G. Rajasekaran *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys., 6 Apr. 1968 p 521–525 (See N70-17766 06-29)
Avail: AEC Depository Libraries

In the approaches to understanding the observed hadron spectrum, any observed hadron is regarded as a bound or resonant composite formed by forces between other observed hadrons or the observed hadrons are considered to be bound states of some theoretically existing heavy quarks. In the bootstrap model the forces are calculated from exchanges of the known hadrons between known hadrons and the positions or coupling constants of the composite are predicted. In the quark model some forces between the quarks are postulated and the spectrum of quark bound states is predicted. Both approaches are applied to the question of whether the Y* (1405) hadron is a composite of other observed hadrons or a bound state of heavy quarks. Since the K matrix for the observed hadron channels does not have a pole near the Y* (1405) hadron, it is concluded that this hadron is not a bound state of heavy quarks. R.B.

N70-17836# Saha Inst. of Nuclear Physics, Calcutta (India).
WEAK AXIAL VECTOR COUPLING CONSTANT IN THE STATIC CHEW-LOW MODEL
T. Pradhan and M. Pattnaik *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys., 6 Apr. 1968 p 528–530 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

The Adler-Weisberger sum rule obtained from equal time commutation relations for weak axial vector current is compared to the Chew-Low sum rule in the static model of nucleon interactions obtained from the equal time anticommutation relations for the pseudoscalar current. It is necessary to clearly distinguish the strong current which satisfies the equal time anticommutation relation from which the Chew-Low model is derived. Sum rules are constructed for calculating the weak axial vector coupling constant renormalization. The sum rules obtained contain integrals over p-wave pion-nucleon cross sections for actual massive pions and the strong interaction form factor which occurs in the Adler-Weisberger sum rule does not appear. R.B.

N70-17837# Tata Inst. of Fundamental Research, Bombay (India).
DALITZ PLOT FOR ETA MESON YIELDS 3 PION DECAY AND DELTA I = 1 RULE
Aditya Kumar and R. Ramachandran *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys., 6 Apr. 1968 p 531–533 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

A previous phenomenological analysis of the Dalitz plot for the eta-meson yields 3 pion decay is determined to be invalid because of misrepresentation of the experimental data. Theoretical support is offered for the presence of quadratic matrix elements in the decay process which avoid the problem of the vanishing matrix element predicted by current algebra. A quadratic equation is derived which gives a better fit to the Dalitz plot than the linear matrix element. R.B.

N70-17838# Saha Inst. of Nuclear Physics, Calcutta (India).
A MODE MODEL FOR PION-PION SCATTERING IN THE I=J=0 CHANNEL
Haridas Banerjee, B. Dutta-Roy, and V. J. Menon *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys., 6 Apr. 1968 p 534–537 refs (See N70-17766 06-29)
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A possible solution for pion-pion scattering in the I=J=0 channel is that the scattering length is large negative, the phase passes through zero around 350 MeV, and there is a very broad resonance in the neighborhood of the mass. This model is used to explain available experimental data on the 3 pion decay modes of eta-mesons and neutral L Kaons. The model permits the abnormally low value for the reported branching ratio to be explained without using the hypothesis of the presence of I=2 components in the electromagnetic current of hadrons. R.B.

N70-17839# Delhi Univ. (India). Dept. of Physics and Astrophysics.
CURRENT ALGEBRA TO PION NEUTRON YIELDS NEUTRON PION PION PROCESS AND COUPLING CONSTANT SUM RULES
A. N. Mitra and Ravinder Nath *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys., 6 Apr. 1968 p 538–541 ref (See N70-17766 06-29)
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The pion production process in the pion nucleon yields nucleon 2 pion reaction is analyzed using the current algebra technique and assuming the amplitudes are dominated by poles arising due to single particle states and low resonances in order to

obtain relationships between various coupling constants of strongly interacting particles. The problem of ambiguous terms is also considered. R.B.

N70-17840# Tata Inst. of Fundamental Research, Bombay (India).
A TADPOLE MODEL FOR NON-LEPTONIC DECAYS BASED ON CURRENT ALGEBRA AND SPECTRAL FUNCTION SUM RULES
Arvind Kumar and L. K. Pandit *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 542–545 ref (See N70-17766 06-29)
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The tadpoles for the model are provided by the neutral Chi meson for the parity conserving and by the neutral Kaon for the parity violating decays. PCAC is assumed for the neutral Kaon and PCVC for the neutral Chi meson field. As an example, the Chi meson field operator is assumed to be proportional to the divergence of the strangeness-changing member of the vector current octet. The PCVC assumption makes the model basically different from the earlier tadpole models which assumed the existence of a normal scalar meson octet. The scalar tadpole neutron Chi meson has missing unitary partners and in the limit of SU(3) it disppears since strangeness-changing vector currents are also conserved in this limit. In this case the p-wave non-leptonic decays depend on the breakdown of SU(3) symmetry. R.B.

N70-17841# Tata Inst. of Fundamental Research, Bombay (India).
NEW SUPERCONVERGENCE RELATIONS FOR MESON-BARYON AND BARYON-BARYON
Y. M. Gupta and A. Rangwala *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 546–549 refs (See N70-17766 06-29)
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In previous considerations of superconvergence sum rules the spin structure of the scattering amplitudes are such that none of the invariant amplitudes is superconvergent. New superconvergence relations are proposed which require only that the symptotic behavior of the invariant amplitude for different scattering systems be governed by a single Regge trajectory. The forward direction only is considered for the given nucleon scattering processes and the linear combinations of the invariant amplitudes are discussed for the processes in which absorptive parts are directly related to the total cross sections. In order that the Regge trajectory govern the asymptotic behavior in the t-channel, linear combinations of the total cross sections are formed which correspond to definite isospin and G-parity in the crossed channel. R.B.

N70-17842# Tata Inst. of Fundamental Research, Bombay (India).
VECTOR-MESON DOMINANCE AND NON-LEPTONIC HYPERON DECAYS
Arvind Kumar *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 550–552 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

A previous proposition that the amplitude of threshold meson-baryon scattering is exactly given by the vector meson exchange coupled to the conserved F-spin is shown to be consistent with current algebra and yields precisely the results of SU(6) symmetry. A similar proposition is developed for non-leptonic hyperon decay amplitudes and the results are shown to be parallel to current algebra and SU(6) symmetry. For the parity-violating case, the universality of the weak spurion D/F is proved if the amplitude obtained from the vector dominance proposition is equated to that given by dispersion theory. However, since the parity-conserving weak spurion determines the parity-violating amplitudes in current algebra, the method of threshold meson-baryon scattering must be applied to the parity-conserving amplitudes. R.B.

N70-17843# Windsor Univ. (Ontario).
PION PHOTOPRODUCTION BY CURRENT ALGEBRA TECHNIQUES
M. S. Bhatia and P. Narayanaswamy (Tata Inst. of Fundamental Res.) *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 553–556 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Using SU(2) X SU(2) current algebra of vector and axial currents, the low energy relationship of pion photoproduction is derived. However, this strength creates problems, because the amplitude does not satisfy the gauge constraint when the pion is off the mass shell. By using an off-mass shell amplitude and by selecting six of the invarient amplitudes in the decomposition, it is shown that after imposing the pole dominance of the divergence of the axial current and obtaining the physical amplitude from the low energy theorems, the resulting amplitude satisfies the gauge constraint explicitly. The differential cross sections and multipole amplitudes are computed by standard techniques. The detailed predictions for angular distributions and excitation spectra in the low energy region and for the threshold values of the electric transition amplitude compare favorably with the experimental numbers for the charged pion production processes. The results of calculation predict different numbers in comparison to simple Born calculation for charged modes. R.B.

N70-17844# Allahabad Univ. (India). Dept. of Phys.
THE NEGATIVE PION-PROTON INTERACTIONS IN THE PERIPHERAL MODEL
V. P. Seth, C. P. Singh, B. K. Agarwal, and Y. M. Gupta *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 557–561 refs (See N70-17766 06-29)
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The matrix elements for given positive pion and neutron exchange diagrams are derived from application of the Chew-Low method to the negative pion + proton yields positive pion + negative pion + neutron reaction. From evaluation of the factors in the given expression for the differential cross section, the various angular and momentum distributions of positive and negative pions in the reaction can be deduced. R.B.

N70-17845# Delhi Univ. (India). Centre for Advanced Study in Physics.
UNITARITY CORRECTIONS TO LOW ENERGY PARAMETERS IN SOFT PION CALCULATIONS
S. C. Bhargava, S. N. Biswas, K. C. Gupta, and K. Datta *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 562–568 refs (See N70-17766 06-29)
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Unitarized are the results of soft pion current algebra calculations on low energy parameters for S-wave pion nucleon scattering in the isotopic spin = 1/2 channel in the context of a N/D formalism. The corrections arising from unitarity, off shell kinematics, and off shell dynamics are clearly isolated. Author

N70-17848# Indian Statistical Inst., Calcutta.
PHOTOPRODUCTION OF NEUTRAL PIONS ON Li-7
G. Ramachadran, N. D. Prabuakar, and A. K. Rej *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 569–572 refs (See N70-17766 06-29)
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The photoproduction of neutral pions on lithium-7 is studied in both elastic and inelastic channels leading to excited states. Spin-dependent and spin-independent contributions are estimated separately by assuming an L-S coupling shell model with oscillator wave functions. Results justify the neglect of spin-dependent contributions in the case of elastic production although they are comparably large in elastic channels. G.G.

N70-17847# Delhi Univ. (India). Dept. of Physics and Astrophysics.
GLAUBER MODEL OF HIGH ENERGY SCATTERING FROM FADDEEV'S THREE-BODY FORMALISM
V. S. Bhasin and V. S. Varma *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 573–576 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Glauber's model for high energy scattering is developed from Faddeev equations by retaining terms up to the second order in the expansion of the scattering amplitude. It is assumed that the off-energy shell two particle amplitudes are functions only of the momentum transfer and that the internal motion of the deuteron is small compared to that of the incident particle; the elastic proton-deuteron scattering amplitude, on integrating over the relative angle between the initial and final proton moments delivers a first term corresponding to single scattering, a second term similar to the Glauber term, and a third term representing the contribution from double scattering which is ignored when the high energy proton-deuteron scattering amplitude is written in the usual Glauber form. Quantitative estimates on the effects of this extra term on the Glauber model indicate that for two particle amplitudes the contribution of the third term is about 7% of the Glauber contribution to the scattering amplitude. G.G.

N70-17848# Poona Univ. (India). Dept. of Physics.
STRUCTURE AND POLARIZATION DEPENDENCE IN THE ROSENBLUTH FORMULA
R. G. Takwale *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 577–579 refs (See N70-17766 06-29)
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The Rosenbluth formula for elastic electron-nucleon scattering is generalized to include simultaneously spin vectors of both the interacting particles in the initial and final states and also the mass of the electron. The formulae are expressed in terms of charge and magnetic form factors of nucleons. Model calculations consider the scattering of unpolarized electrons by a polarized proton target, high energy electron scattering by nucleons, the scattering of a nonpolarized high energy electron beam by polarized proton target, and the scattering of protons by a completely polarized beam of electrons. G.G.

N70-17849# Indian Inst. of Tech., Kanpur. Dept. of Physics.
MASS SPECTRUM FROM MODEL FIELD THEORIES
P. K. Patnaik *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 580–582 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

An attempt is made to obtain a mass spectrum dynamically by taking lograngian to write the field equation containing two zero mass particles and approximating the propagator by truncating four particle correlations to two particle correlations. There are five massive solutions along with two zero mass solutions. If instead of two interacting fields three interacting fields are assumed, three zero mass solutions are found. G.G.

N70-17850# Madras Univ. (India). Dept. of Physics.
DECAY RATES OF H-3 AND H-4
G. Bhamathi and K. Prema *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 583–588 refs (See N70-17766 06-29)
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Calculated are the negative pion decay modes of the hypernuclei H-3 and H-4 by evaluating the spin of the nuclei as well as the lambda hyperon decay interactions. Wave function are obtained by solving the corresponding hypernuclei bounds with the assumption of pairwise separable interaction between the constituents of the hypernucleus. Using suitable wave functions for the initial and final state nuclei, the matrix elements for two body decays are found and the decay rate is calculated. For the lambda-hyperon H-3, the experimental ratio of 4/14 is used to calculate the small proton spin ratio in the two body model. In the case of the three body model, the proton/spin ratio is sensitive to the binding energy used and decreases with the value of the experimental ratio. G.G.

N70-17851# Tata Inst. of Fundamental Research, Bombay (India).
BARYON RESONANCES: A REVIEW
A. Subramanian *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 589–605 refs (See N70-17766 06-29)
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Techniques of discovery and study of baryon resonances are described and some classification procedures are outlined. This review draws from recent developments quoted in published literature on the subject as well as from individual publications. Baryon resonances are characterized by a definite mass, a width of lifetime and quantum numbers for spin, parity, isospin, strangeness or hypercharge, etc. Regge poles and quark models are used to classify the baryon resonances in included tables. G.G.

N70-17852# Tata Inst. of Fundamental Research, Bombay (India).
MESON RESONANCES (REVIEW)
P. K. Malhotra *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 606–625 refs (See N70-17766 06-29)
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This survey contains the generalities known on meson resonances and discusses briefly some of the more recent boson resonances. A true resonance is defined by definite quantum numbers and definite mass and width values. Meson states are studied for bosons by invariant mass, missing mass spectrometry, and quantum number determinations. The mathematical quark model represents mesons as quark-antiquark systems. A mass formula defines mesons by a first order breakdown of unitary symmetry and accounts well for the masses of the numbers of 0 negative octet. An attached list contains all the mesons which are reasonably certain to exist and some of those already classified as nonets. G.G.

N70-17853# Tata Inst. of Fundamental Research, Bombay (India).
HYPERFRAGMENTS
M. S. Swami *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 626–634 (See N70-17766 06-29)
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In case of high energy interactions, hyperfragments are formed during the evaporation stage of the highly excited heavy nucleus of emulsion; in negative kaon captures hyperfragments are formed at the break-up stage of light nuclei of emulsion. The available experimental data could be understood by assuming that the sticking probability of lambda hyperon to a fragment is a function of two parameters, namely mass of the fragment; the sticking probability of lambda hyperon to the fragment increases with increase of the mass if the relative velocity parameter is kept constant. Lambda hyperon sticking frequency to the fragment decreases with increase of relative velocity parameter when the fragment mass is constant. It is concluded that lambda hyperon sticking probability to a fragment is a product of the two parameters considered and functional dependence of the two parameters may be obtained. Author

N70-17854# Delhi Univ. (India). Dept. of Physics and Astrophysics.
ESTIMATION OF THE PRIMARY ENERGY IN SINGLE COLLISION INTERACTIONS WITH A NUCLEON
B. Bhowmik and S. Singh *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 635–638 ref (See N70-17766 06-29)
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A critical study of the prevalent indirect methods (based on angular distribution of showers) of estimating the primary energy, has been made and a more realistic method has been suggested. For studying the different methods, the data on 23 GeV/c proton-nucleon and 16 GeV/c pion-nucleon interactions have been utilized. The persisting primaries were excluded from the individual events and composite events of low and high multiplicity were formed. Author

N70-17855# Delhi Univ. (India). Dept. of Physics and Astrophysics.
CHARACTERISTICS OF PARTICLE PRODUCTION IN THE INTERACTION OF 22.8 GeV/c PROTONS WITH LIGHT NUCLEI IN EMULSION
B. Bhowmik and R. K. Shivpuri *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 639–641 ref (See N70-17766 06-29)
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The features of the fast secondary particles have been studied and in order to determine effects of the secondary collisions, the results have been compared with the data on proton-nucleon collisions. The mean multiplicity of secondary shower tracks is found to be (4.7 + or - 0.3). Comparison of the multiplicity distribution with that from proton-nucleon collisions suggests that in collisions with light nuclei the multiplicity distribution is not significantly affected by the possible generation of low energy particles due to secondary collisions. Number of collisions within the light nucleus was determined from the mean number of grey tracks produced in interactions with light nuclei and the mean multiplicity of fast particles (n sub f) in proton-nucleon collisions. Using the values of multiplicity of various particles as given in a table, the value of n sub f has been found to be 6.3 and the number of secondary collisions has been found to be 0.4. Author

N70-17856# Aligarh Muslim Univ. (India). Dept. of Physics.
EMISSION OF FAST DEUTERONS AND TRITONS FROM 24 GeV/c PROTON INTERACTIONS
A. R. Ansari, K. B. Lal, A. H. Naqvi, and M. Shafi *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 642–648 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Results from nuclear emulsion studies on fast deuteron and triton emissions from 24 GeV/c proton interactions show that the mean heavy prong number for deuteron producing stars is slightly higher than that for proton producing stars. Deuteron distribution is similar to that of cascade protons and both particles peak strongly forward in the angular direction. It is also seen that in high excitation stars with more than 17 heavily ionizing particles, the frequency of deuterons per star is larger than that for stars with about 8 heavily ionizing particles. Yield data on tritons and He-3 per star indicate that the frequency of triton emission is identical with that of He-3 emission. There is also evidence that these particles are strongly collimated in the forward direction. G.G.

N70-17857# Punjab Univ., Chandigarh (India). Dept. of Physics.
ON THE ENERGY SPECTRUM OF PIONS AND PROTONS IN PION-NUCLEON (17 GeV/c) AND PROTON-PROTON (24 GeV/c) COLLISIONS
D. P. Dubey, U. S. Kushwaha, and M. S. Swami *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 649–651 (See N70-17766 06-29) ref
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Examined are the energy spectra of backward pions and protons from pion-nucleon interactions and that of pions only from proton-proton collisions. It is assumed that: (1) isobars are produced with small transverse momentum; (2) they decay isotropically in their rest system; (3) light isobars decay through emission of a single pion; and (4) heavy isobars decay via emission of two pions. It is shown that in both 17 FeV/c pion-nucleon and 24 GeV/c proton-proton collisions, the production of heavy isobars takes place with decay by emission of more than one pion and a small fraction of energy. Single isobar production does not seem to be important. G.G.

N70-17858# Osmania Univ., Hyderabad (India). Dept. of Physics.
SOME ASPECTS OF ANTIPROTON-NUCLEON INTERACTIONS AT 5 GeV/c
S. V. Padmavathi, Rukmini Rao, and A. A. Kamal *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 652–656 refs Supported by the Dept. of At. Energy (See N70-17766 06-29)
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From along the track scanning, about 1400, stars were detected on a track length of 322 m. The observed M.F.P. is in excellent agreement with the value of 23 cms., obtained from the attenuation of primary stars along the beam direction using a constant density model for the average emulsion nucleus, together with the known composition of standard emulsion. The observed M.F.P. implies an inelastic cross-section of 50 mb/ nucleon, averaged over protons and neutrons—a value which is not significantly different from that of 47 mb/proton obtained in the hydrogen bubble chamber experiment at similar energy. The result is approximate in that the Pauli's principle, which would suppress the forward elastic scattering, has been ignored. Author

N70-17859# Osmania Univ., Hyderabad (India). Dept. of Physics.
RE-EMISSION OF ANTIPROTONS FROM THE INTERACTIONS OF ANTIPROTONS AT 5 GeV/c
Indira Raghavan, S. V. Padmavathi, A. Santhalakshmi, and A. A. Kamal *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 657–662 Supported by the Dept. of At. Energy (See N70-17766 06-29)
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A stack of 41 pellets of nuclear emulsion was exposed to a beam of antiprotons of about 5.0 GeV/c. Beam tracks were well collimated and calibrated for ionization and spurious scattering. A strip in the middle of the pellets area scanned and primary as well as secondary stars were identified by tracing back the tracks through successive emulsions until elastic scattering or interaction was found. Multiple scattering together with ionization measurements on connecting tracks established the number of surviving anti-protons as 208 after correction for geometrical and other losses. Since 95 percent of the stars from which anti-protons emerge have less than or equal to 3 heavily ionizing particles, it was assumed that these events corresponded to interactions with single nucleons. The probability of re-emission of anti-protons from those stars is therefore 0.46 in relation to 0.16 for star fractions found along track scanning. The comparatively smaller mean multiplicity for non-annihilation events indicates their pheripheral character. G.G.

N70-17860# Punjab Univ., Chandigarh (India).
BASIC FEATURES OF QUASI TWO BODY CHANNELS PRODUCED IN KAON-PROTON INTERACTIONS AT 6 GeV/c
S. K. Tuli *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 663–666 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Some aspects of two body processes in K negative kaon proton interactions at 6 GeV/c are presented in this paper. The experiment was performed by synchrotron using the 1.5 m hydrogen bubble chamber. The exposure consisted of 300,000 good photographs. The analysis is based on 18,000 two prong events. Conventional measuring devices were used for obtaining the digital data which was reduced by using standard computer codes for geometrical reconstruction and kinematic fitting. The two body

processes discussed here come from the reactions of negative kaons with protons resulting in (1) pion, neutral kaon, and negative pion; (2) lambda hyperon, positive pion, and negative pion; and (3) lambda hyperon, positive pion, negative pion, and neutral pion. Author

N70-17861# Punjab Univ., Chandigarh (India). Dept. of Physics.
SOME ASPECTS OF TRANSVERSE MOMENTUM AT 17.2 GeV PION-NUCLEON INTERACTIONS
J. M. Kohli *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 667–669 refs (See N70-17766 06-29)
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Experimental results for pion-nucleon interactions based on transverse momentum are explained by using an isobar model. In pion-nucleon collisions both, boson resonant states and nucleon states, are excited so that the pion isobar moves in the forward direction and the heavy isobar in the backward direction. The general behavior of the transverse momentum along with its average value depends on the distributions from the boson states at small angles and from pion heavier isobars as the bosons move forwards. G.G.

N70-17862# Osmania Univ., Hyderabad (India.) Dept. of Physics.
COHERENT PRODUCTION OF PIONS IN HIGH ENERGY NEGATIVE PION INTERACTIONS
A. A. Kamal, Y. V. Rao, and Rukmini Rao *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 670–674 refs Supported in part by Min. of Educ., India (See N70-17766 06-29)
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Analyzed is the extent to which light and heavy nuclei of an emulsion contribute to coherent pion production in high energy negative pion interactions. A cross section of 1.7 mb/carbon is used to calculate the expected mean free paths considering the various contributions possible from light and heavy nuclei (CNO,Agr). Obtained results strongly suggest that light nuclei predominantly contribute to the process. G.G.

N70-17863# Tata Inst. of Fundamental Research, Bombay (India).
BINDING ENERGIES AND POSITIVE PION DECAY OF LIGHT HYPERFRAGMENTS
K. N. Chaudhari, S. N. Ganguli, N. K. Rao, M. S. Swami, A. Gurtu et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 675–679 refs Prepared in cooperation with Punjab Univ. (See N70-17766 06-29)
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A stack of emulsion pellets was exposed to negative K-mesons of 350 MeV/c. The central regions of the stack were scanned for hyperfragments caused by stopping the negative K-mesons and all hyperfragments of more than or equal to 1 micron m range were recorded. Secondary prongs from the decay of hyperfragments were followed till they were brought to rest, interacted in flight, or left the stack. In this manner 1312 negative pion-mesic decays and 3 positive pion-mesic decays were observed. Computer analysis of all events which decayed by visual pionic modes identified 544 events and the variations in binding energy as a function of mass number of the hyperfragments are shown in table form. Results showed that there was no discrepancy in range-energy relations for two as well as three-body decay modes of the hydrogen 4 lambda hyperon. G.G.

N70-17864# Tata Inst. of Fundamental Research, Bombay (India).
THE RATIO OF NON-MESIC TO NEGATIVE PION-MESIC DECAY OF LIGHT HYPERFRAGMENTS
K. N. Chaudhari, S. N. Ganguli, N. K. Rao, M. S. Swami, A. Gurtu et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 680–684 refs Prepared in cooperation with Punjab Univ. (See N70-17766 06-29)
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Described is a new method for determining the charge spectrum of hyperfragments (HFs) from their range-spectrum; the procedure is based on the fact that an analysis of world data of uniquely charge identified mesic HFs, produced by stopping negative K - mesons, reveals a marked variation of their range distribution with increasing charge of HFs; using world data as a calibration spectrum for various charges of HFs, a least square fit method obtains charge spectrum of HFs in the sample. Author

N70-17865# Tata Inst. of Fundamental Research, Bombay (India).
FINAL STATE INTERACTIONS IN THE DECAY OF LIGHT HYPERFRAGMENTS
K. N. Chaudhari, S. N. Ganguli, N. K. Rao, M. S. Swami, A. Gurtu et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 685–688 refs Prepared in cooperation with Punjab Univ. (See N70-17766 06-29)
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In the present investigation an attempt has been made to study the excited states of Li-4, Li-5, and Be-8 by analyzing final-state interactions in the mesic decays of He-4 lambda hyperon, He-5 lambda hyperon, and Li-8 lambda hyperon, respectively. For this purpose an emulsion stack was used to stop a negative kaon beam, scanned for hyperfragments, and observed data were analyzed by computer. The number of uniquely identified He-4 lambda hyperons, He-5 lambda hyperons, and Li-8 lambda hyperons was 62, 195, and 47, respectively; the number of non-unique He-4,5 lambda hyperons was 347. Author

N70-17866# Delhi Univ. (India). Dept. of Physics and Astrophysics.
FREQUENCY OF He-8 NUCLEI AMONG 'HAMMER TRACKS' IN NUCLEAR EMULSION
B. Bhowmik, T. Chand, and D. V. Chopra *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 689–692 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Determined is the frequency of He-8 fragments among hammer tracks produced by 1.5 GeV/c negative k-mesons in hypersensitized emulsion. Track width measurement technique was employed to distinguish between fragments of different charges. The width measurement were made at each micron interval, assuming a uniform cylinder of 2 micron length and diameter equal to the core width. Out of 110 hammer tracks, 75 hammer tracks having projected ranges approximately 20 micron and situated approximately 25 micron m away from air and glass surfaces of the emulsion were subjected to track width measurements. The results show that nearly 13 percent of the hammer tracks are due to He-8 fragments, 84 percent are due to Li-8 fragments, and three percent are due to B-8 fragments. Author

N70-17869 Pennsylvania State Univ., University Park.
ENERGY LEVELS OF Sm-152 AND Gd-152 POPULATED BY THE DECAY OF Eu-152m
Lloyd Gilbert Multhauf (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-5579

The decay of Eu152 has been investigated to gain more information on the level structures of the nuclei Sm 152 and Gd152 which lie in the collective model transition region. Eu152 was produced by thermal neutron bombardment of natural Eu203. Gamma rays were identified by half life comparisons and by conicidence measurements. Ge(Li) measurements were used to determine the energy values and relative intensities of most of the gamma rays observed. Author

N70-17882# European Atomic Energy Community, Ispra (Italy).
PANEL DISCUSSION ON FUTURE TRENDS IN PHYSICAL MEASUREMENTS AND NUCLEAR INSTRUMENTATION
Brussels CID Oct. 1969 69 p refs Presented at the Ispra

Nucl. Electron. Symp., Ispra, Italy, 9 May 1969 (EUR-4290e) Avail: CFSTI

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N70-17885# Institute for Nuclear Physics Research, Amsterdam (Netherlands).

CONTRASTS AND SIMILARITIES IN SYSTEMS BASED ON LARGE AND ON SMALL COMPUTERS

L. J. Lidofsky (Columbia Univ., New York) *In* Euratom Panel Discussion on Future Trends in Phys. Meas. and Nucl. Instr. Oct. 1969 p 11–26 refs (See N70-17882 06-24)
Avail: CFSTI

The differing requirements for computing power and for response and execution times in solving nuclear experiments are discussed. Several existing large and small scale computer systems used with broad application in nuclear structure research are described. Three other systems having particular features of interest are also considered. Within the framework of the requirements, a point by point comparison is made between a generalized large scale system and one based on recently available smaller computers. It is concluded that in general and at the present time the requirements may be met with a system based on a small or a medium scale computer. Author

N70-17887# Ecole Normale Superieure, Paris (France). Lab. de L'Accelerateur Lineaire.

SOME APPLICATIONS OF THE THEORY OF STOCHASTIC PROCESSES TO NUCLEAR ELECTRONICS

G. Amsel, R. Bosshard, R. Rausch, M. Sauce, and C. Zajde *In* Euratom Panel Discussion on Future Trends in Phys. Meas. and Nucl. Instr. Oct. 1969 p 45–54 (See N70-17882 06-24)
Avail: CFSTI

Applications of autocorrelation and cross correlation techniques are discussed. Illustrations include the calculation of the sum of weighted autoconvolutions of spectra, point processes generated by a discriminator with Poisson input and dead time, measurements of highly fluctuating phenomena, and correlation techniques applied to time of flight measurements. N.E.N.

N70-17899 Tennessee Univ., Knoxville.

ORDER DEPENDENCE OF THE MOESSBAUER ISOMER SHIFT OF THE GOLD 197 NUCLEI IN THE COPPER-GOLD ALLOY SYSTEM

Paul Gordon Huray (Ph.D. Thesis) 1968 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-7162

In the Cu-Au alloy system, the arrangement of the atoms may be modified by heat treatment. The lattice may thus be highly ordered or may be given various degrees of disorder. By making use of this property and the nuclear monopole interaction it is possible to explore the charge distribution about individual atoms. The change of electronic charge on the Au-197 atoms which accompanies a change of order in several Cu-Au alloys has been observed through the Mossbauer isomer shift. The experimental isomer shift and resistivity results are given for a series of 23 different alloys of Cu-Au and 3 different alloys of Ag-Au. Two standard heat treatments were used for these alloys. Isomer shift and resistivity results are given for a Cu3Au alloy following quenches from temperatures in the range 250 C to 800 C. Dissert. Abstr.

N70-17910# Helsinki Univ. (Finland). Reactor Lab.

ABOUT THE ABSOLUTE ACTIVITY MEASUREMENTS OF RADIOACTIVE NUCLIDES

A. Vuorinen (Ph.D. Thesis) 1969 7 p refs
Avail: CFSTI

The coincidence method for absolute activity measurements counts alpha, beta, and gamma radiation from decaying nuclides as well as electron capture nuclides when capture is followed by gamma emission. The most accurate results are given by 4 pion p.c.-gamma-gamma coincidence measurements when directly applicable. Successful measurements by coincidence methods are also reported for nuclides decaying by isomeric transition, X-X emission, gamma-gamma emission, and even with pure electron captures. G.G

N70-17913 Texas A&M Univ., College Station.

ELASTIC AND INELASTIC SCATTERING OF NEUTRON CAPTURE GAMMA RADIATION

Victor Edward Michalk (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-5142

The complex scattering spectra resulting from neutron capture gamma irradiation of various targets have been studied using a large volume lithium drifted germanium detector. Because of the improved resolution of Ge(Li) detectors, the inelastic peaks are resolved in the spectra. Transitions to lowlying states are compared to known low level energy schemes, and the isotopes responsible for resonance scattering are identified. Branching ratios are measured, and angular distribution measurements are made for some of the decay transitions to low-lying states. Dissert. Abstr.

N70-17947 Cincinnati Univ., Ohio.

A MODIFIED CNDO APPROACH TO THE QUANTUM MECHANICAL STUDY OF MOLECULAR ELECTRONIC SPECTRA AND STRUCTURE

Janet Elaine Del Bene (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-6334

The ultraviolet spectra of compounds containing both Pi and lone-pair electrons have been of great interest to spectroscopists and theoretical chemists. The CNDO (complete neglect of differential overlap) method, has been able to predict ground state properties of molecules quite well, but has yielded unreasonable results when applied to the determination of the energies of excited states. These energies can be obtained by employing the standard virtual orbital approximation, followed by a configuration interaction calculation. A careful study of the CNDO method and the calculated spectroscopic quantities resulting from its use, indicated that it would be necessary to introduce two changes in the method if CNDO calculations were to become useful for predicting and interpreting spectroscopic data. Dissert. Abstr.

N70-17952 Brandeis Univ., Waltham, Mass.

A MODEL OF ELECTRON BUBBLE IN SUPERFLUID HELIUM

Hai Tung Li (Ph.D. Thesis) 1968 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-5447

The radical and surface mode oscillations of the electron bubble are investigated and the frequencies of these oscillations are obtained. Two different approaches are used to obtain the static deformation energy of the bubble. The first is based on a coordinate transformation formalism and the second is based on a

method first developed by Rayleigh. Classical equation of motion approach is then used to study the oscillatory motion of the electron bubble. The problem of time-dependent boundary condition in quantum mechanics is examined and some illustrative examples are given. Dissert. Abstr.

N70-18007 Rensselaer Polytechnic Inst., Troy, N.Y.
INVESTIGATION OF THE FAST PHOTONEUTRON SPECTRUM OF OXYGEN ABOVE THE GIANT RESONANCE REGION
Paul Curtis Nagle (Ph.D. Thesis) 1968 201 p refs
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 69-6472

Photoneutron spectra from the reaction O-16(gamma,n)O-15 were measured at bremsstrahlung end point energies in 5 MeV steps between 39.3 MeV and 65 MeV for a reaction angle of 67.5 deg. Also, photoneutron spectra at 55 MeV for reaction angles of 30 deg and 135 deg were obtained. Cross sections in the photon energy range of 35 to 65 MeV at 67.5 deg for the transitions to the ground state and 6.16 MeV excited state of O-15 are reported. Angular distributions for neutron groups of 5 MeV widths are presented along with the cross sections in the giant resonance region for reaction angles of 30 deg, 67.5 deg, and 135 deg at a photon energy of approximately 55 MeV. The experimental results indicate that there is no structure in the ground state contribution to the total O-16(gamma,n) cross section. A branching ratio of 3:1 is determined for the 6.16 MeV excited state and ground state contribution to the total (gamma,n) cross section in the tail region The experimental techniques as well as the data analysis procedure are discussed. Dissert. Abstr.

N70-18008 Louisiana State Univ., Baton Rouge.
STUDIES IN MOLECULAR LUMINESCENCE
Keith George Stolzie (Ph.D. Thesis) 1968 186 p refs
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-4501

Consideration is given to the transfer of triplet state energy by radiationless processes. These processes are studied by means of their effects on observable radiative events. Two main approaches are taken in these studies: phosphorescence and fluorescence excitation spectra are employed to determine if there is quenching or intersystem crossing at energy levels which are higher than the ground vibrational levels of the excited states of molecules; and luminescing solutes in solid matrices are studied by means of the temperature dependence of the phosphorescence life-time; this approach is used in three different types of system: a) aromatic solutes in crystalline aromatic solvents; b) aromatic solutes in polymethylmethacrylate (lucite); c) aromatic solutes in alcohols. The first of the two approaches, the study of excitation spectra, yielded only moderately good results. It appears that there is considerable quenching at levels of higher energy than the ground vibrational levels of excited states. The second of the two approaches yielded good results in the case of the mixed crystal systems. It has been shown, quite conclusively, that the main radiationless transfer of triplet state energy is intermolecular, not intramolecular. Dissert. Abstr.

N70-18020 Texas Christian Univ., Fort Worth.
ABSORPTION SPECTRA OF LITHIUM, SODIUM, AND INDIUM IN SOLID XENON, KRYPTON, AND ARGON
George Victor Marusak (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-6601

The absorption spectra of lithium, sodium, and indium in solid rare gases were obtained from samples formed and observed at 4.5 K. A 1-meter concave grating spectrograph with photographic recording was used to obtain the spectra. Studies were made of lithium in xenon, krypton, and argon, and of sodium and indium in xenon. Rare gas to metal molar ratios of 250:1 to 1000:1 were used. Emphasis was placed on the study of the resonance transitions of the trapped atoms, corresponding to transitions at 6708 A for lithium, at 5890 A and 5896 A for sodium, and at 4102 A for indium in the gas phase. In all cases a multiplet structure, whose center of gravity was shifted to higher energies with respect to the gas phase atomic transition, was observed. The multiplet structure is explained by assuming that one component is due to well isolated metal atoms and that the other components are due to metal-metal atom interactions between atoms trapped at nonnearest-neighbor substitutional sites in the host lattice. The energies of the interacting metal atoms are calculated from diatomic potential curves. The shifts with respect to the gas phase of the components due to well isolated atoms in xenon, krypton, and argon are calculated by using a Lennard-Jones (6-12) potential for the interaction between the trapped metal atoms and the rare gas atoms. Dissert. Abstr.

N70-18045# Amsterdam Univ. (Netherlands).
PROPERTIES OF THE DEFORMED NUCLIDES PRODUCED IN THE DECAY OF Ho-166, Ho-166m, Tm-166, Yb-166, Os-180, Re-180, Os-181 AND Os-181m, AND BY CAPTURE OF THERMAL NEUTRONS IN Ta-181
Pieter Frank Arnold Goudsmit (Ph.D. Thesis) Jan. 1969 159 p refs Submitted for publication Sponsored in part by AEC and Found. for Fundamental Res. and the Neth. Organ. for Pure Sci. Res.
Avail: CFSTI

Some of the nuclear models used for the description of deformed nuclei are surveyed to provide background information about the theoretical expressions used. A series of measurements on the decay of holmium and thulium are reviewed. The nuclear properties of the states in Re-180 and W-180 excited in the decay of Os-180 and Re-180 are described, and measurements on the decay of two Os-181 activities are given. The conversion electrons following capture of thermal neutrons in Ta-181 are determined. R.B.

N70-18094# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
HARD KAON AND PION CALCULATIONS OF THE DECAYS K SUB A YIELDS K RHO MESON AND K SUB A YIELDS K RESONANCE PION
Prem P. Srivastava 1968 26 p refs *Its* Notas de Fisica Vol. 14, No. 8
Avail: CFSTI

The strong decays K sub A yields K rho, K resonance pion are discussed in a current algebra approach by writing unsubtracted dispersion relations for the matrix elements of appropriate retarded commutators of currents or current divergences between single particle states and vacuum, at (arbitrary) fixed linear combination of the two momentum transfers. The pole contributions is retained from both the variables. Moreover, the various form factors appearing in the calculation are allowed to satisfy at most one subtracted dispersion relation and are treated on equal footing. The current algebra method is used to set up sum rules among the coupling constants and the subtraction constants without using the hypothesis of partial conservation of axial current. Their solution allows calculation of the partial decay widths and the Weinberg Sum Rules are rederived as selfconsistency conditions. Author

N70-18111 Maryland Univ., College Park.
THE TRANSVERSE DIELECTRIC CONSTANT OF THE DEGENERATE ELECTRON GAS
Herbert Allan Trenchard (Ph.D. Thesis) 1968 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-4619

The response function measuring the intensity of the interaction between an electromagnetic wave and a degenerate electron gas is studied. In particular, the frequency and wave number dependent transverse dielectric constant defined by Maxwell's field equations is derived in terms of a sum over the quantum mechanical interaction matrices of this system. Using the methods of second quantization and representing the interaction matrices in terms of Feynman diagrams, the imaginary part of the transverse dielectric

constant is shown to be given strictly in terms of a set of irreducible Feynman diagrams. The imaginary part of the transverse dielectric constant is calculated using this formalism. When electron-electron interactions are included, it is found necessary to include certain sums of high order irreducible diagrams to avoid mathematical divergencies in the results. Dissert. Abstr.

N70-18112# Rutgers Univ., New Brunswick, N.J. Nuclear Physics Lab.

NUCLEAR STRUCTURE PHYSICS WITH THE 18 MeV TANDEM VAN DE GRAAFF ACCELERATOR Progress Report, 1 Jul. 1967 – 30 Jun. 1969

G. M. Temmer 30 Jun. 1969 109 p refs
(Grants NSF GP-6579; NSF GP-8033; NSF GP-10748)
Avail: Issuing Activity

Work with the tandem nuclear accelerator constituted various studies on particle scattering and lifetime measurements, excitation and angular correlation experiments, as well as particle decay and isobaric analog state observations. Theoretical research centered on particle scattering in nuclear reactions and particle-hole interactions with their various states. G.G.

N70-18115 Texas Univ., Austin.

SIZE EFFECTS AND DOPPLER-SHIFTED CYCLOTRON RESONANCE OF HELICONS IN COPPER

Lowell Thomas Wood (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-8243

Size effects and Doppler-shifted cyclotron resonance of helicons have been studied in single crystals of very pure copper. Frequencies from 1.0 kHz to 2.0 MHz and magnetic fields up to 27 kG were used. All measurements were done at 4.2 K. Signals were coupled into the sample by means of a small coil of rectangular cross section having about 200 turns of No. 42 wire placed as close to the sample as possible. A similar coil on the other side of the sample picked up the transmitted signal. A phase sensitive detection system was used to detect the signals. Signal strength was found to depend very strongly on the orientation of the magnetic field with respect to the crystal axis. This strong angular dependence can result from open orbit electrons or large magnetoresistance. When either open orbit electrons or a large magnetoresistance is present, care must be taken in aligning the magnetic field along a crystal axis. Dissert. Abstr.

N70-18124 University of Southern Calif., Los Angeles.

LAMBDA HYPERON-SIGMA HYPERON CONVERSION AND LAMBDA HYPERON NUCLEON NUCLEON ISOSPIN ZERO BOUND STATES

Alan James Toepfer (Ph.D. Thesis) 1968 69 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-6508

In the present work, the shift in binding energy of the Lambda hyperon nucleon-nucleon isospin zero, spin 1/2 and 3/2 systems due to virtual reversible Lambda hyperon nucleon to Sigma hyperon nucleon transitions was calculated. The Faddeev multi-particle scattering formalism along with nonlocal, separable, spin-dependent, charge symmetric, S-wave potentials was used, and a coupled set of one-dimensional, linear integral equations for the Lambda hyperon-deuteron, S-wave, elastic scattering amplitudes was derived. The two-body Lambda hyperon nucleon interactions were fit to the Lambda hyperon nucleon singlet and triplet shape-independent parameters, and the Sigma hyperon nucleon interactions were related to the Lambda hyperon nucleon potentials using two different symmetry models. All calculations in the spin 1/2 state were made using purely attractive potentials, while for some cases in the spin 3/2 state, a repulsive core was included in the Lambda hyperon nucleon potential. It was determined that the effect of a finite coupling to the Sigma hyperon-channel was to reduce the binding energy of the Lambda hyperon nucleon-nucleon system in both the doublet and quartet spin states. Dissert. Abstr.

N70-18163# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.

RADIOACTIVE CONTAMINATION IN WORKSHOPS AND LABORATORIES. VOLUME 2: COLLECTIVE PROTECTION TECHNIQUES

J. P. Perotin et al 1968 92 p refs Transl. into ENGLISH of CEA report SPR/67-558
(AERE-Trans-1105; SPR/67-558) Avail: CFSTI; HMSO 13s; BIS $2.80

The subject is reviewed under the following headings: General properties of contaminants; characteristics of atmospheric contamination; trapping contamination; localization of contamination; entrainment of contamination; purification of air; discharge into external atmosphere; contamination of surfaces. Author

N70-18187 Pennsylvania State Univ., University Park.

FORM FACTORS IN WEAK AND ELECTROMAGNETIC INTERACTIONS

Michael Manyel Fitelson (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-5544

The consequences of a modification of the one photon electron vertex function are explored. It was discovered that if the high energy ($-q\ sq \approx (1\ BeV)sq$) behavior of the electron was such that it acquired an intrinsic anomalous magnetic moment of .001 (alpha/2 pi) certain aspects of e-e and e-p scattering would be greatly affected. This effect is brought about without appreciably changing the anomalous magnetic moment induced by radiative corrections, and such that the Ward–Takahashi identity is satisfied. The effects of this modification were found to be quite striking with regard to polarization in e-p scattering and the angular dependence of the e-e differential scattering cross section. The formal solution to the algebra of currents is used to find approximate expressions for the K sub l3+ decay and nucleon form factors. A good part of the low energy behavior of these form factors is explained by this approach. Dissert. Abstr.

N70-18208# Stanford Univ., Calif. Nuclear Engineering Lab.

ACTIVATION MEASUREMENTS OF THE DOPPLER EFFECT IN URANIUM-238 AND THORIUM-232 AS A FUNCTION OF SURFACE AREA-TO-MASS RATIO

Robert N. Whitesel Dec. 1969 225 p refs
(Grants NSF GK-3131; NSF GK-1274)
Avail: CFSTI

The primary purpose of detailed analyses and experiments was to compare the prediction of resonance absorption theory with measurements of the Doppler effect in U-238 and Th-232, over a range of surface-to-mass ratios not previously studied. The measured and calculated results are plotted as S/M functions, and agreement between theory and experiment is considered excellent for both elements. It was concluded that the measurements can easily be extended to the oxides of both thorium and uranium and U-235 metal, and that experiments could be performed at higher temperatures if the development of cadmium fluoride foil holders is pursued. The experimental setup, which involved a Doppler-effect double oven, appears well suited to the specific goals, although performance could be improved by a new design that allows better thermal isolation of the test locations while permitting accurate flux normalization. Finally, the excellent results obtained using the Doppler ratio technique led to recommendation of its utilization in future investigations of this type. A.C.R.

N70-18207# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.

BARYON RESONANCES IN NUCLEI

Leonard S. Kisslinger [1969] 9 p refs Sponsored in part by NSF
Avail: CFSTI

The traditional treatment of the nucleus as a system of neutrons and protons is questioned for nuclear processes involving

energy levels of hundreds of MeV. Arguments are given to suggest that the degrees of freedom associated with baryonic resonances must be explicitly included for these particular properties. The discussion includes analysis of the forces which bind the baryonic resonances to nucleons and a review of present indications of the role played by these resonances in high-energy back scattering of protons on deuterons. A.C.R.

N70-18220# Michigan Univ., Ann Arbor. Dept. of Physics.
NEUTRON-PROTON, NEUTRON-DEUTERON, AND NEUTRON-NUCLEUS TOTAL CROSS SECTIONS AT 4.0 GeV/c AND 5.7 GeV/c
E. F. Parker and L. W. Jones Nov. 1969 78 p refs
(Grant NSF GP-13265)
(TR-03028-3-T) Avail: CFSTI

Neutron total cross sections have been measured for H2, D2, He, Be, C, Al, Fe, Cu, Cd, W, Pb, and U at 5.7 + or − 0.6 Gev/c incident momentum. The hydrogen and deuterium cross sections were also measured at 4.0 + or − 0.6 Gev/c. The deuteron screening factor was determined from the hydrogen and deuterium cross sections. The resulting values are compared with the previous experimental evaluations and theoretical predictions. The total cross section vs atomic number data were fitted to an optical model. Author

N70-18230 Rensselaer Polytechnic Inst., Troy, N.Y.
THE TEMPERATURE DEPENDENCE OF EPITHERMAL NEUTRON CAPTURE AND FISSION IN URANIUM 235 DIOXIDE
Frederick Carl Schoenig, Jr. (Ph.D. Thesis) 1968 175 p
Avail: Univ. Microfilms HC $8.00/Microfilm $3.00 Order No. 69-6476

The temperature dependence of epithermal neutron capture and fission in enriched uranium dioxide rods was measured in a 1/E epithermal spectrum. Experiments performed in the reflector of the thermal test reactor have studied the Doppler effect on U-235 O2 fission, and experiments to 1278 C in the core of the Union Carbide Research reactor have investigated the Doppler effect on U-235 O2 capture and fissions. The samples were cylindrical pellets, 0.341 inches in diameter, mounted between similar pellets to simulate a rod. This UO2 rod was irradiated at various temperatures in a cadmium covered furnace which was water-cooled. Three dilute gold-in-aluminum alloy wires were placed symmetrically about the furnace exterior for neutron flux normalization. Dissert. Abstr.

N70-18260# General Electric Co., Pleasanton, Calif. Vallecitos Nuclear Center.
APPLICATIONS OF NEUTRON RADIOGRAPHY USING A RADIOACTIVE NEUTRON SOURCE
D. G. Albertson and D. P. Rathke Dec. 1969 12 p
(NEDO-12048) Avail: CFSTI

A neutron source composed of Am-241, Be, and Cm-242 was used for neutron radiographic inspection of turbine blades and other practical objects. Residual fragments of core material from the investment casting process as small as 10 mg were imaged in the turbine blades. A neutron radiograph of a pneumatic connector clearly showed the presence and orientation of rubber O-rings and a plastic ferrule within a steel casing. A conceptual design has been prepared for an industrial facility that would produce good neutron radiographs for exposure times less than 10 minutes. Author

N70-18282 Purdue Univ., Lafayette, Ind.
A SYSTEMATIC SEARCH FOR STRANGE PARTICLE DECAYS IN PION–PROTON INTERACTIONS AT 5.0 GeV/c
Paul Jerome Weisbach (Ph.D. Thesis) 1968 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-7514

This report presents a study of strange particle production in pion–proton interactions at 5.0 GeV/c incident pion momentum. Particular emphasis is placed on the search for nonstrange nucleon resonances with strange particle decays. Cross sections are given for the observed final states. Multibody final states are examined for resonance production. Cross sections for the more prominent resonances are determined. Dissert. Abstr.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-16932*# Computer and Applied Sciences, Inc., Philadelphia, Pa.
MHD BOUNDARY LAYERS WITH NON-EQUILIBRIUM IONIZATION AND FINITE RATES Quarterly Report 1 Jun.–1 Sep. 1969
Arthur Sherman, Hsuan Yeh, and Eli Reshotko [1969] 38 p
(Contract NASw-1866)
(NASA-CR-107804) Avail: CFSTI CSCL 20I

The problem being considered is the boundary layer that will develop over the segmented electrode wall in an MHD channel when a non-equilibrium plasma is flowing. We have developed a theoretical analysis for a non-equilibrium boundary layer explicitely taking into account the electron temperature differential equation and the plasma sheath. This analysis was developed using a finite difference format so that finite electrodes along a wall could be treated in a non-similar manner. The present program seeks to extend this earlier study to include finite ionization and recombination rates in order to make the analysis apply in a more realistic way to physically important situations. Author

N70-16988*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF PLASMA RADIATION Semi-Annual Status Report Mar.–Aug. 1969
Hans R. Griem and S. R. Greig [1969] 5 p refs
(Grant NGR-21-002-073)
(NASA-CR-107794) Avail: CFSTI

Profiles of the Stark-broadened emission lines of Al 1048 A and Al 1067 A were compared with those of Lyman alpha and beta to determine the product of the damping constant and the oscillator strength for each of the argon lines. The truncated profiles of the Lyman alpha and beta lines were also used for temperature measurements based on the relative intensity of the lines. Measurements on the broadening of the neutral helium lines 3889 A and 5016 A were analyzed. Profiles were recorded of the ionized helium resonance line 304 A. Collective Bremsstrahlung from collision free shock waves was investigated. Profiles for the emission of far infra-red radiation from hydrogen gas were determined. D.L.G.

N70-17018# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Electrophysics.
ELECTROMAGNETIC WAVE PROPAGATION IN UNIAXIAL PLASMAS WITH CURVED MAGNETIC FIELD
Henry J. Stalzer, Jr., Jerry Shmoys, and Leopold B. Felsen Jul. 1969 196 p refs
(Contract F19628-68-C-0072)
(AD-694499; PIBEP-69-024; AFCRL-69-0340; SR-5) Avail: CFSTI CSCL 20/9

The effect of the curvature of an impressed static magnetic field on the propagation and diffraction of electromagnetic waves in a uniaxial plasma is studied. The model chosen for the analysis is two dimensional with the magnetic field lines consisting of concentric circles. Ray optical techniques are used to construct approximate solutions to the field radiated from a line source in the unbounded medium and one into which a perfectly conducting or

a transparent cylinder is introduced. The radiated, reflected, refracted and diffracted fields calculated by ray optics are then validated by obtaining exact integral representations for the solutions to several canonical problems and evaluating these integrals asymptotically for high frequencies. The agreement between the ray optical results and the asymptotic approximations validates the ray optical procedure and suggests its usefulness in obtaining approximate solutions to more general configurations which are not amenable to a rigorous analysis. The center of curvature of the magnetic field lines in the unbounded medium acts as a scatterer and is shown to be analogous to the vertex of a wedge. When cylindrical boundaries are introduced, the diffracted field consists of creeping rays which are excited by rays which are incident either tangentially or at the critical angle. Author (TAB)

N70-17079# City Coll. of the City of New York. Dept. of Civil Engineering.

VELOCITY SPACE DIFFUSION AND LANDAU DAMPING IN COLLISIONAL PLASMAS

Kwok-Leung Li and Norman C. Jen 1 Sep. 1969 65 p refs

(Grant AF-AFOSR-1093-69)

(AD-696150; AFOSR-69-2734TR; Rept-69-14) Avail: CFSTI CSCL 20/9

The statistical behavior of a completely ionized plasma in which collisional effects are included is described by the Vlasov equation coupled to the Poisson equation, terms suggested by the Krook relaxation model and the isotropic Fokker-Planck model being chosen as collision operators. As a result of perturbations on the background distribution function, longitudinal oscillations are set up and the plasma diffuses in velocity space as a consequence of wave-particle interaction. The coupled equations are solved by the method of characteristics in the Fourier transformed space, employing the quasi-linear approximation developed by Drummond, Pines, Vendenov, Velikhov and Sagdeev. The longitudinal behavior of the plasma is followed into the quasi-linear regime in which both collisional and collisionless Landau damping and velocity space diffusion mechanisms are investigated. The rate of dissipation is shown to have collisionless as well as collisional attributes. Author (TAB)

N70-17116# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

NUMERICAL TREATMENT OF THE POSITIVE COLUMN OF A GAS DISCHARGE WITH SLAB SYMMETRY FOR THE ENTIRE RANGE OF PLASMA DENSITIES Final Scientific Report

Karl G. Guderley and Emma M. Valentine Jul. 1969 184 p refs

(AD-697032; ARL-69-0118) Avail: CFSTI CSCL 20/9

The positive column of a gas discharge is mathematically described by a system of four non-linear differential equations containing an adjustable parameter which plays the role of an eigenvalue. Some coefficients of the system contain a factor representing the ion density at the center of the slab, and this factor may assume extremely high values. In the present report a procedure is shown which makes it possible to solve this system of differential equations and to determine the eigenvalue for any value of the ion density no matter how large. For high ion densities a straightforward approach will lead to a tremendous loss of accuracy, although the problem by itself is well posed. This difficulty is partially overcome by a method due to Guderley and Nikolai. But the resulting equations still contain particular solutions which decrease extremely rapidly; one obtains stiff equations for which the usual integration techniques can proceed only in very small steps. In the present report the method of Guderley and Nikolai is still used in the vicinity of the wall. In the remaining portion of the flow field a transformation is carried out by which the particular solutions that cause stiffness are nearly decoupled from the rest of the system and can be dealt with by semianalytic means. The transformation of the differential equation requires considerable attention to analytic details otherwise inadvertent losses of accuracy may be encountered. Author (TAB)

N70-17123# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

EXPERIMENTS ON THE MINIMUM POWER INPUT OF A ROTATING PLASMA

B. Lehnert, J. Bergstroem, S. Holmberg, and E. Tennfors 31 Oct. 1969 50 p refs Sponsored by Swed. Atomic Res. Council and Bank of Swed. Tercentenary Fund

(Rept-69-34) Avail: CFSTI

A sharply defined minimum temperature and power input exists below which a fully ionized plasma cannot be kept in a stationary state in surrounding neutral gas. Previous investigations on the minimum power are herein extended to a large range of parameters, and it is found that superimposition of high-frequency and viscous shear heating in a rotating hydrogen plasma yields nearly the same total minimum power as pure viscous heating. Author (ESRO)

N70-17256# Ohio State Univ. Research Foundation, Columbus.

PLASMA DIAGNOSTIC TECHNIQUES AND GENERATION USE IN FLIGHT CONTROL DIVISION'S PLASMA FACILITY Final Report, 1 Oct. 1967 – 30 Sep. 1968

Marion L. Pool Nov. 1968 63 p refs

(Contract F33615-68-C-1086)

(AD-696692; AFFDL-TR-69-1) Avail: CFSTI CSCL 20/9

A magnetic bottle and its associated two-phase 4-MHz oscillator are now in operation in a new building. Many details of the plasma-producing device have had additional improvements. The construction and development of a static discharge system, an arc discharge assembly, and a P.I.G. facility were carried out. Diagnostic plasma measurements were made with microwave horns, Langmuir probes, and Fabry-Perot interferometers. Determinations have been made on the electron number densities and velocity flows under different controlled conditions at various locations in the plasma. Additional tools, such as the Brush cathode and the conductivity probe, have been constructed and tested. Author (TAB)

N70-17294# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

ELECTRON DENSITY AND TEMPERATURE STUDY OF PLASMAS USING A MILLIMETRE-WAVE FABRY-PEROT INTERFEROMETER [ETUDE DE LA DENSITE ELECTRONIQUE ET DE LA TEMPERATURE DE PLASMAS A L'AIDE D'UN INTERFEROMETRE FABRY-PEROT EN ONDES MILLIMETRIQUES]

Daniel Bize Nov. 1969 169 p refs In FRENCH; ENGLISH summary

(CEA-R-3748) Avail: CFSTI

Measurements were made of the electronic density in the range from 10 to the 9th to 10 to the 14th power electrons/cm. The electron temperature of plasmas formed by laser ionization and high frequencies was also measured. Author (ESRO)

N70-17512# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

A POSSIBLE METHOD FOR THE ELIMINATION OF THE CRITICAL VELOCITY PHENOMENON IN A ROTATING PLASMA

B. Lehnert 19 Nov. 1969 8 p refs

(Rept-69-33) Avail: CFSTI

The velocity limitation observed under stationary operation of fully ionized rotating plasmas is caused by enhanced non-thermal ionization in thin partially ionized wall layers which are formed close to the end insulators. One important link in this mechanism consists of azimuthal electric field inhomogeneities. It should be possible to suppress the mechanism by means of concentric metal rings which short-circuit the azimuthal electric field within the wall layers. If these predictions are true, the plasma can then be accelerated beyond the velocity limit. Author (ESRO)

N70-17516# Aix-Marseilles Univ. (France). Inst. de Mecanique des Fluides.
THEORETICAL AND EXPERIMENTAL STUDY OF PHENOMENA ACCOMPANYING NONEQUILIBRIUM CONDITIONS IN A CLOSED CYCLE GENERATOR [ETUDE THEORIQUE ET EXPERIMENTALE DES PHENOMENES ACCOMPAGNANT LA MISE HORS D'EQUILIBRE DANS UN GENERATEUR A CYCLE FERME]
Jacques Valensi and Jean Pierre Petit 15 Mar. 1969 58 p refs In FRENCH; ENGLISH summary
Avail: CFSTI

Research into the phenomena encountered in closed cycle MHD generators was conducted using non equilibrium ionization and a combustion driven shock tube with special attention to the occurrence of electrothermal instability. Experiments were carried out in a linear Faraday nozzle with segmented electrodes. A mixture of 70% helium and 30% argon, was used as the working fluid instead of an Alcali seeded noble gas, as in conventional generators. The gas temperature being initially taken between 4000 K and 6000 K, a strong non equilibrium effect was observed without the occurrence of any instability. Theoretical calculations of the electrical characteristics of the generator and of the critical and local Hall coefficients support this result. However, under the same conditions but for T sub g = 3000 K electrothermal instability may develop. Author

N70-17525# California Univ., Los Angeles. School of Engineering and Applied Science.
OPTIMIZATION PROBLEMS IN THERMONUCLEAR PLASMA CONFINEMENT
P. K. C. Wang Oct. 1969 18 p refs Presented at Symp. on Optimization, Nice, 29 Jun.–5 Jul. 1969
(Grant AF-AFOSR-1547-68)
(AD-696657; AFOSR-69-2749TR) Avail: CFSTI CSCL 18/1

The problem of thermonuclear plasma confinement by means of external time-varying electromagnetic fields is explored from the viewpoints of optimal control theory. Using the Boltzmann-Vlasov mathematical model for a collisionless plasma, various mathematical formulations of the confinement problem are discussed. Specific results in the form of necessary conditions for optimality are obtained for the cases where confinement is achieved by means of (1) a spatially uniform time-varying magnetic field and (2) a spatially uniform time-varying electric field in the presence of a strong static magnetic field. Physical interpretations of these results are given. Author (TAB)

N70-17529*# Illinois Univ., Urbana.
PLASMA PHYSICS
M. Raether, H. Boehmer, D. Bollinger, J. Chang, K. Evans et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 85–107 refs (See N70-17526 06-34)
Avail: CFSTI CSCL 20I

The effect of collisions on the instability of cold and warm electron beams in a plasma was investigated experimentally. It is found that the instability is effectively suppressed for velocity spread much smaller than previously assumed. Computer calculations are presented that support this finding. The spatial–temporal development of the instability in the presence of boundaries is discussed theoretically. Author

N70-17564# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT SEVENTEENTH SIX-MONTHLY PROGRESS REPORT, 1 JANUARY – 30 JUNE 1969
Jun. 1969 9 p refs
(NP-18027; PR-17) Avail: CFSTI

Continuing research is briefly described for the following: (1) plasma sources, (2) hydromagnetic ionizing fronts, (3) hydromagnetic wave propagation in axially nonuniform magnetic fields, and (4) laser diagnostics. NSA

N70-17570# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONTRIBUTION TO THE EXPERIMENTAL STUDY OF WAVE PARTICLE INTERACTIONS IN A PLASMA HAVING A TWO-POPULATION ELECTRONIC DISTRIBUTION FUNCTION [CONTRIBUTION A L'ETUDE EXPERIMENTALE DE L'INTERACTION ONDES-PARTICULES DANS UN PLASMA PRESENTANT UNE FONCTION DE DISTRIBUTION ELECTRONIQUE A DEUX POPULATIONS]
Rene Franck (Ph.D. Thesis -Paris Univ., 19 Jun. 1968) Sep. 1969 69 p refs In FRENCH; ENGLISH summary
(CEA-R-3720) Avail: CFSTI

This report concerns an experimental study of the energy exchanges between the electrostatic waves and energetic electrons in a plasma characterized by a so-called 'bump in tail' distribution function. In order to carry out this work it was necessary to design a special electrostatic separation probe to make precise measurements of the evolution of the electron distribution both in space and time. It was thus possible, in a hydrogen plasma generated by a hot cathode, to study two distinct regimes. In the first case the conditions required for the application of the quasi-linear theory were verified and the development of the instability and the deformation of the distribution function were studied with precision. In the second case the wave-electron interactions were much stronger than those for which quasi-linear theory normally apply and some neutral gas was ionized. However, it was shown that even in this second case quasi-linear theory still qualitatively holds. Author (ESRO)

N70-17612# Stanford Univ., Calif. Inst. for Plasma Research.
INTERACTION BETWEEN RADIATION AND BOUNDED MEDIA Final Report
O. Buneman 28 Oct. 1969 6 p refs
(Contract AF 49(638)-1524)
(AD-696658; AFOSR-69-2754TR) Avail: CFSTI CSCL 20/9

The report briefly describes the research. A bibliography of reports and articles prepared under the contract for the study of interaction between radiation and bounded media is included. Author (TAB)

N70-17618# Oxford Univ. (England). Engineering Lab.
THE USE OF MICROWAVES FOR THE STUDY OF THERMALLY IONISED GASES Final Report
M. L. G. Oldfield, R. N. Franklin, and D. L. Schultz Jul. 1969 180 p refs
(Rept-1083/69) Avail: CFSTI

Experimental measurements were obtained on the effect of a dc magnetic field on the propagation of microwaves through a weakly ionized, collision dominated, thermal plasma. These measurements were made under conditions where the microwave, plasma, electron collision, and electron cyclotron frequencies are of the same order. The results were then compared with theoretical predictions obtained from a solution of the electromagnetic equations in a homogeneous, anisotropic, magnetized plasma, with approximations and boundary conditions appropriate to those in the experiments. The geometry chosen was that of reflection of 9 GHz microwaves from a plane interface with a uniform equilibrium plasma in a coaxial transmission line, with the magnetic field applied in the direction of propagation. The plasma used was generated by a pressure-driven shock tube, using dry air as the experimental gas. The zero magnetic field propagation case, and the calibration of the shock tube as a plasma source are also considered. Author (ESRO)

N70-17620# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
SOME THEORETICAL ASPECTS OF THE INTERACTION BETWEEN A PLASMA STREAM AND A NEUTRAL GAS IN A MAGNETIC FIELD

J. C. Sherman 1969 51 p refs
(Rept-69-29) Avail: CFSTI

Theoretical applications of the interaction that takes place when a plasma stream moves through a neutral gas across a magnetic field are discussed. Particular aspects of the diverse theories were singled out and idealistically dealt with to demonstrate the role played by the various physical processes. ESRO

N70-17635*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLOSED-FORM APPROXIMATE SOLUTIONS TO THE OSCILLATORY PLASMA CONTINUITY EQUATIONS
Lester D. Nichols and J. Reece Roth Washington Jan. 1970 10 p refs
(NASA-TM-X-1944) Avail: CFSTI CSCL 20I

Recent experimental observation of continuity-equation plasma oscillations has made desirable an improved closed-form approximation to the nonlinear differential equations which describe them. Such an approximation has been found, and is compared with the less satisfactory approximations previously obtained, and also with the exact solutions to these equations obtained by numerical integration. Author

N70-17870# Aix-Marseilles Univ. (France). Inst. de Mecanique des Fluides.
STUDY OF THE INTERACTION OF A MAGNETIC FIELD AND AN IONIZED GAS DISCHARGE: STUDY OF THE PHYSICAL PROPERTIES OF PLASMA AND ITS AERODYNAMIC BEHAVIOR [ETUDE DE L'INTERACTION D'UN CHAMP MAGNETIQUE ET D'UN GAZ IONISE EN ECOULEMENT: ETUDES DES PROPRIETES PHYSIQUES DU PLASMA ET DE SON COMPORTEMENT AERODYNAMIQUE]
B. Forestier, B. Fontaine, P. Bournot, and P. Parraud [1969] 77 p refs In FRENCH
(Contract DRME-67-34-591-00-480-75-01)
Avail: CFSTI

The behavior of an argon plasma ionized by supersonic flow is investigated when it is subjected to the effects of acclerated Laplace forces. Behavioral predictions from two theories are compared with experimental results. Changes in the experimental setup permitted the use of diagnostic means in obtaining values of the plasma interaction parameters. The influence of strong current density on the conductivity of the plasma was determined. Measurements questioning the height of the transverse distribution of the potentials in the aerodynamic nozzle were made. Measurement techniques established for plasma conductivity, velocity, and electron density were recommended. Transl. by M.H.E.

N70-17896 Florida Univ., Gainesville.
ELECTRON GAS BEHAVIOR IN THE BASE AND MIXING REGIONS OF A WEAKLY IONIZED PLASMA FLOW AT AN ABRUPT INCREASE IN CROSS SECTION
Charles William Greene (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-5389

The electron behavior in a weakly ionized argon plasma jet exhausts into a quiescent medium. The low pressure subsonic jet, studied under conditions which are steady but not necessarily field free, is found amendable to both theoretical and experimental analyses. Results obtained in the core and developed flow regions are in agreement with those obtained by other investigators. Particular attention is given to the electron gas behavior in the base and jet mixing regions due to both normal and superimposed potentials in the base region. A mathematical model, based on a known initial electron density profile, is developed for predicting electron number densities within the jet flow. Detailed velocity, electron temperature, and electron number density profiles, obtained using conventional gas dynamic probing techniques, including the Langmuir probe, are presented. Dissert. Abstr.

N70-18027 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN EXPERIMENTAL STUDY OF THE PHOTOIONIZATION PRODUCED BY GASEOUS DISCHARGES IN AIR, OXYGEN, AND NITROGEN
George Thomas Hummert (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-6585

The basic experimental technique employed in this study is to measure the current out of an ion-collector located at a known distance from a gaseous discharge. For each gas investigated this procedure is repeated at various gas pressures and distances between study: a positive, point-to-plane corona and the ion-collector. Two types of discharges are employed in this study: a positive, point-to-plane corona and a uniform-field discharge. The data obtained using the corona discharge source are compared with the results reported by several other investigators, and the conclusion reached that the spectrum of photoionization radiation produced by a discharge in these gases is relatively independent of E/p, where E is the electric field in the discharge and p is the gas pressure. The photoionization observed at some point in the gas is more correctly described as a function of pressure times distance to the discharge rather than a function of E/p in the discharge. Dissert. Abstr.

N70-18172# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE PLASMA FOCUS OF A COAXIAL INJECTOR
R. P. Vasilev et al 21 Mar. 1969 22 p refs Transl. into ENGLISH from The Russian
(AD-696545; FTD-MT-24-444-68) Avail: CFSTI CSCL 20/9

Using a coaxial injector with deuterium, the authors study parameters of the plasma focus. A Fabry-Perot interferometer with neon-helium laser as illuminator is used in conjunction with a camera and oscillograph to record density distribution in plasma discharges. Soft x-ray, an electron-optical camera, plastic scintillator, and a pinhole camera with Al and Be film absorbers are used to measure plasma temperature. The spectrum of plasma in the visible region is recorded with the aid of an ISP-51 spectograph and electron-optical camera. Resulting spectrograms were used for independent monitoring of temperature and density of plasma in the focus region. Author (TAB)

N70-18228# Technische Hogeschool, Eindhoven (Netherlands).
VARIATIONAL APPROACHES AND MARGINAL STABILITY OF COLLISIONLESS PLASMA EQUILIBRIA
Franco Santini (Ph.D. Thesis) 1969 95 p refs
Avail: CFSTI

New approaches to the problem of equilibrium and stability of plasmas described by the Maxwell and the Vlasov – Boltzmann equations are investigated. Information theory and variational properties of a collisionless plasma with a magnetic field, and the thermodynamics of a collisionless plasma at equilibrium in a magnetic field are topics covered in prescribing suitable functionals. Interchange stability of plasmas at low frequencies and without the restriction of low frequency is considered for adiabatic magnetoplasmas and plasmas from the maximum entropy conditions. Marginal stability of an inhomogeneous finite plasma, at equilibrium with an electric field, is investigated for linear electrostatic pertubations. J.M.C.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-18934*# Martin Marietta Corp., Baltimore, Md.
LOW TEMPERATURE SPECIFIC HEAT OF VANADIUM CARBIDE
D. H. Lowndes, Leonard Finegold, and R. G. Lye Oct. 1969

22 p refs
(Contract NASw-1290)
(NASA-CR-107790; RIAS-TR-69-15c; TR-9) Avail: CFSTI CSCL 20L

The specific heat has been measured at low temperatures for four large crystals of VC sub x, with results that indicate the presence of maxima near x = 0.85 in both the Debye characteristic temperature and the electronic density of states at the Fermi level. This behavior suggests that the maximum melting temperature of VC sub x occurs at a composition close to that of the ordered compound V6C5, rather than at the composition VC sub 0.75 proposed recently by Rudy. The variation of the Fermi level with x has been used to obtain an estimate for the density-of-states curve in the vicinity of the Fermi level. The result is discussed in terms of the behavior expected from elementary considerations of the electronic structure. Author

N70-16960# Rochester Univ., N.Y. Inst. of Optics.
BASIC RESEARCH IN OPTICS Final Report, 1 Feb. 1965 – 31 Jul. 1969
Kenneth J. Teegarden 20 Oct. 1969 17 p refs
(Grants AF-AFOSR-236-65; AF-AFOSR-236-67)
(AD-696654; AFOSR-69-2666TR) Avail: CFSTI CSCL 20/12

The major achievements of the research during this period were the growth of large single crystals of argon, krypton, and xenon and the observation of X-ray induced luminescence in the crystals; the development of apparatus for, and the measurement of, double quantum absorption in solids and liquids; the measurement of photoemissive yields from films of solid xenon and krypton; the measurement of the absorption spectra of alkali halides at low temperature; and the discovery of electro luminescence in single crystals of the alkali halides. Author (TAB)

N70-16986# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
A STRUCTURAL INVESTIGATION OF NON-CRYSTALLINE NICKEL-PHOSPHORUS ALLOYS
G. S. Cargill, III Aug. 1969 68 p refs
(Contracts N00014-67-A-0298-0009; ARPA SD-88)
(AD-696944; TR-23) Avail: CFSTI CSCL 20/2

The structure of non-crystalline electrodeposited Ni-P alloys, 73.8 - 81.4 at. % Ni, has been investigated by X-ray scattering and by physical density measurements. Calculated radial distribution functions, RDF(r), indicate that the alloys have a better defined short-range order than that observed in liquid noble metals above their melting points. The non-crystalline alloys are between 0.6% and 1/4% less dense than the corresponding mixtures of fcc Ni and Ni3P, both of which are essentially close-packed. A grain boundary density deficit model has been developed which relates the fractional density difference between the microcrystalline and macrocrystalline forms of a close-packed metal to the minimum average microcrystal grain size. The high densities of the non-crystalline Ni-P alloys suggest that the alloys have a continuous structure rather than one in which internal boundaries separate small, well-ordered regions. Author (TAB)

N70-17021# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
PULSE MEASUREMENTS ON BULK InSb
Th. van de Roer Oct. 1969 19 p refs
(Contract F61052-69-C-0001)
(AD-696677; RADC-TR-69-369) Avail: CFSTI CSCL 20/12

The report describes measurements of current and voltage on InSb bars during pulses of about 10 nsec duration. The experiments were performed at 77 degrees K. The current-voltage characteristics shows a sudden reduction in voltage in the avalanche region at a certain current density. The main influence of a transverse magnetic field is to lower this threshold current. Also several jumps can occur at successively higher currents. Author (TAB)

N70-17024# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1969 Quarterly Technical Summary Report, 1 May – 31 Jul. 1969
Peter E. Tannenwald 23 Oct. 1969 74 p refs
(Contract AF 19(628)-5167)
(AD-696620; ESD-TR-69-211) Avail: CFSTI CSCL 20/12

The report covers in detail the solid state research work at Lincoln Laboratory for the period 1 May through 31 July 1969. The topics covered are Solid State Device Research, Materials Research, and Physics of Solids. Author (TAB)

N70-17041# Delaware Univ., Newark. Dept. of Physics.
EFFECTIVE WORK FUNCTION OF METAL CONTACTS TO VACUUM-CLEAVED PHOTOCONDUCTING CdS FOR HIGH PHOTOCURRENTS Technical Report
Richard J. Stirn and Karl W. Boer Nov. 1969 14 p refs
Presented at the Am. Phys. Soc., Miami, Nov. 1968
(Contract NONR-4336(00))
(AD-697002; TR-28) Avail: CFSTI CSCL 20/12

Stationary cathode-adjacent high-field domains which occur in a range of negative differential conductivity have been used to determine the electron density at the cathode for various metals deposited on vacuum-cleaved photoconducting CdS. Measurements were taken in bandgap light at various intensities and at temperatures ranging from 155 to 300 degrees K. These crystals (doped with Ag and Al) consistently have gains greater than 10 even with metal contacts of Au or Pt. The analysis shows that the effective barrier heights are essentially independent of the metal work function, are dependent on the light intensity and temperature, and are generally lower in magnitude by about 40% as compared to values obtained from photoresponse measurements on CdS with negligible photocurrent. Author (TAB)

N70-17064# Naval Research Lab., Washington, D.C. Optical Sciences Div.
A COMPUTER PROGRAM TO ANALYZE OPTICAL PARAMETRIC UP-CONVERSION PROCESSES IN NONLINEAR CRYSTALS
R. A. Andrews 27 Oct. 1969 23 p refs
(AD-696935; NRL-6941) Avail: CFSTI CSCL 20/6

A FORTRAN computer program has been developed which analyzes a nonlinear material to determine (a) the range of IR wavelengths that can be converted in a phase matched (PM) process, (b) the PM orientation of the wave vectors for critical and noncritical PM, (c) the angular aperture for PM conversion, and (d) the maximum number of resolvable lines for image conversion. These characteristics are determined as a function of IR wavelength for a given pump wavelength, pump radiation divergence, and length of nonlinear crystal. Author (TAB)

N70-17068# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
APPLICATIONS OF CRYOGENIC TECHNIQUES TO MATERIALS RESEARCH
Joachim C. Erdmann Sep. 1969 45 p refs Submitted for publication
(AD-696929; DI-82-0922) Avail: CFSTI CSCL 20/12

Materials research applies cryogenic techniques in two large categories: (1) Investigations of materials properties at low temperatures provides optimal structural components in cryogenic engineering and suitable materials for low-temperature applications. The areas of interest in particular are mechanical, electrical, and thermophysical properties. (2) Solid-state analysis provides general knowledge of materials by methods which require absence or reduction of perturbing thermal excitations. Main areas of research are analysis of lattice defects and impurities, refined constitution analysis by rf and Mossbauer spectroscopy, determination of the Fermi surface, and dielectric and magnetic properties. TAB

N70-17088# Drexel Inst. of Tech., Philadelphia, Pa. Dept. of Metallurgical Engineering.
EFFECTS OF GROWTH MECHANISM ON SOLUTION KINETICS
Richard A. Tanzilli and Richard W. Heckel Oct. 1969 22 p refs
(Contract N00014-67-A-0406-0002)
(AD-696954; TR-3) Avail: CFSTI CSCL 11/6

The solution kinetics of second phases were studied as a function of various initial conditions resulting from either diffusion-controlled growth or interface-reaction-controlled growth prior to solution treatment. Calculations of solution kinetics based upon a planar, finite-geometry model were carried out using numerical methods and computer techniques. It was shown that second-phase particles formed by diffusion-controlled growth and existing in a matrix containing concentration gradients exhibit dissolution kinetics that differ markedly from those of particles formed by interface-reaction-controlled growth. An experimental analysis designed to use solution kinetics measurements to obtain the mechanism of growth of second phases is discussed. The effects of linear-gradient assumptions that have been used in an existing, closed-form, infinite-geometry model are evaluated. Author (TAB)

N70-17103# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
THE METAMAGNETISM OF Ni(NO3)2-2H2O
V. A. Schmidt and S. A. Friedberg 7 Oct. 1969 31 p refs Submitted for publication
(Contract Nonr-760(26))
(AD-696137; TR-15) Avail: CFSTI CSCL 20/12

Magnetization isotherms have been measured for single crystal Ni(NO3)2.2H2O between 1.4 degreos and 4.2 degrees K with fields up to 16 k Oe applied along the a-axis. These isotherms exhibit the metamagnetic threshold phenomenon anticipated on the basis of earlier zero-field susceptibility measurements. The locus of the metamagnetic transition points in the H,T plane forms a smooth phase boundary separating antiferromagnetic and ferro- or paramagnetic regions. Author (TAB)

N70-17211# Ecole Normale Superieure, Paris (France). Lab. de Physique.
LOW TEMPERATURE STUDIES OF RADIATION DAMAGE IN SEMICONDUCTORS Final Scientific Report, 1 Aug. 1966 - 31 Oct. 1968
P. Baruch, J. Bourgoin, A. Brelot, M. Cherki, J. Fischer et al 30 Jun. 1969 57 p refs
(Contract AF 61(052)-67-C-002)
(AD-696681; AFCRL-69-0458) Avail: CFSTI CSCL 20/12

A detailed study of annealing states of n-type Germanium irradiated by electrons at low temperatures was performed through the use of stored energy measurements, photoconductivity, fast pulse annealing and conventional resistivity measurements. The effect of illumination on the annealing rate has been observed. It was found, mainly, that the 65K annealing stage kinetics suggest a rate limited process. No direct influence of the chemical nature of dopant impurities has been found. Illumination shifts this stage down to 20K, indicating that, through an electronic process, one element of the defect pair is mobile. Photoconductivity, effect of uniaxial stress and stored energy measurements was performed on Boron and Aluminum doped Silicon, irradiated between 4K and 300K by 1 to 3 MeV electrons. A level at 0.395 (Aluminum) or 0.430 (Boron) is introduced at room temperature as well as at 4.2K, and anneals around 300C. It is suggested that the defect is a boron interstitial with a trigonal symmetry. Author (TAB)

N70-17289# California Univ., La Jolla. Dept. of Physics.
LOCAL THEORY OF DISORDERED SYSTEMS
William H. Butler and Walter Kohn 10 Nov. 1969 21 p refs Presented at NBS Conf. on Electron. Density of States, Gaithersburg, Md., 5 Nov. 1969
(Contract N00014-69-A-0200-6001)
(AD-697007; TR-2) Avail: CFSTI CSCL 20/12

The most striking characteristic of crystalline solids is their periodicity. As a result of this feature, theoretical descriptions of physical phenomena in such systems are usually given in wave number of momentum space. The reciprocal lattice of a crystal and the Fermi surface of a metal are examples. In a disordered system, on the other hand, there is no such periodicity and momentum space descriptions are much less natural. However, in such systems, physical conditions near a point r, in coordinate space, become independent of the conditions at a distant point r, provided that (the absolute value of (r -r) is large compared to either a characteristic mean free path or some other appropriate length. This suggests that one can analyze a macroscopic disordered system by averaging over the properties of microscopic neighborhoods. The present paper reports some details of such a program which has focused especially on the electronic density of states. TAB

N70-17281# Technion - Israel Inst. of Tech. Haifa. Dept. of Materials Engineering.
QUANTITATIVE ANALYSIS OF DISLOCATION DISTRIBUTIONS
David G. Brandon and Yigal Komen Aug. 1969 37 p refs
(Contract F61052-69-C-0042)
(AD-696660; MED-19; AFOSR-69-2807TR; SR-1) Avail: CFSTI CSCL 20/2

A method is described for determining the distribution of dislocations in a metal from observations made by their film electron microscopy. The necessary conditions for the observed distribution to be representative of the bulk structure are given and the parameters derivable from the distribution are discussed in terms of bulk microstructural parameters directly related to the mechanical properties. Author (TAB)

N70-17301*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF TECHNIQUES FOR THE GROWTH OF BULK SINGLE CRYSTALS OF SEVERAL 3-5 COMPOUND SEMICONDUCTORS
John J. Haggerty and Joseph F. Wenckus Jun. 1969 67 p refs
(Contract NAS12-2020)
(NASA-CR-86308) Avail: CFSTI CSCL 20B

Techniques have been developed to produce high quality single crystals of GaAs, InAs, GaP, InP, GaSb and InSb. The reported procedures were used successfully for all of these materials with the exception of InP. Single crystals of InP could not be grown from commercially available raw materials; all of the boules were equiaxed polycrystalline and two phase. Author

N70-17358# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EFFECT OF DIVALENT IMPURITIES ON SOME PHYSICAL PROPERTIES OF LITHIUM FLUORIDE AND SODIUM FLUORIDE [INFLUENCE DES IMPURETES DIVALENTES SUR QUELQUES PROPRIETES PHYSIQUES DU FLUORURE DE LITHIUM ET DU FLUORURE DE SODIUM]
Carlo Laj (Ph.D. Thesis—Paris Univ., 5 May 1969) Sep. 1969 140 p refs In FRENCH; ENGLISH summary
(CEA-R-3869) Avail: CFSTI

The ionic thermocurrent technique is applied to the study of impurity vacancy dipoles in LiF and NaF doped with several divalent cations. In LiF, only one ITC band is observed whatever the impurity studied. In NaF, two ITC bands are present, one corresponding to the one observed in LiF, the other one, intense in the case of small impurities, occurs at lower temperature. A parallel EPR study in the case of Mn2(+) doped samples shows that the band observed in LiF and the corresponding one in NaF are due to the relaxation of dipoles formed by the association of an impurity and a vacancy in the next-nearest position. It is shown that the isolated cation vacancy originating from the dissociation

at room temperature of M(++) [+] is responsible for the enhancement of the gamma-ray coloration of LiF doped with divalent cation impurities. A paramagnetic center ascribed to the presence of Mn(o) isolated in the lattice was also studied. The value of the hyperfine interaction and its temperature dependence are in good agreement both with theory and other experimental results. It is also shown that the disappearance of dipoles by annealing is related to the formation of complexes involving OH ions, probably of the M(OH)2 type, with the two OH ions occupying a single fluorine site. Author (ESRO)

N70-17367# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.

VANADIUM L SUB 2, 3 X-RAY EMISSION AND ABSORPTION SPECTRA FROM METAL, OXIDES, NITRIDE, CARBON AND BORIDE Summary Technical Report, May 1968 – Apr. 1969

David W. Fischer Sep. 1969 57 p refs

(AD-697027; AFML-TR-69-143) Avail: CFSTI CSCL 20/12

The vanadium L(II, III) X-ray emission and absorption spectra (wavelength about 24A) from pure metal, oxides, nitride, carbide, and boride were investigated using a plane-crystal vacuum spectrometer with electron beam excitation and flow-proportional detection. Emission spectra were studied over a wide range of accelerating voltages and takeoff angles, showing that satellite emission and self-absorption effects can cause gross distortion in band shapes. A replica of the L(II, III) absorption spectrum can be constructed solely from emission spectra afflicted with widely different amounts of self-absorption. The L(II, III) emission spectra from the oxides and nitride exhibit an anomalous crossover transition from the 2p level of the anion to the L(II) and L(III) levels of vanadium. This transition appears to be related to the degree of anion-cation orbital overlap and to the electrical properties of the material. Energy shifts of emission bands and absorption edges indicate the charge flow from vanadium to anion in the oxides and nitride. The L(III) edges are used to estimate the width of the forbidden gap in V2O5. Oxygen K emission from the oxides exhibits a peculiar dependence on the dispersing crystal used and is also influenced by satellite emission and self-absorption. Author (TAB)

N70-17438*# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.

SOLID STATE STUDIES IN CERAMIC ALLOYS Quarterly Progress Report, 1 Jun. – 31 Aug. 1969

Robert G. Lye and John D. Venables 31 Aug. 1969 18 p refs

(Contract NASw-1290)

(NASA-CR-107864; QPR-16) Avail: CFSTI CSCL 20L

Results of a two-phase program of research are reported. The first phase deals with the band structure and bonding of refractory carbides, nitrides, and their alloys. The following topics are discussed: (1) interatomic charge transfer and ionic bonding in TiC, (2) optical reflectivity, (3) nuclear magnetic resonance, and (4) specific heat of VC. The second phase is concerned with electron microscope studies of ceramic alloys. Emphasis was directed towards determining why the high temperature mechanical properties of TiC-VC alloys differ markedly from those of the parent monocarbides. D.L.G.

N70-17513# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF THE CRYSTALLOGRAPHIC AND MAGNETIC PROPERTIES OF CUBIC MANGANITE SPINELS NiMn SUB 20 SUB 4 [ETUDE DES PROPRIETES CRISTALLOGRAPHIQUES ET MAGNETIQUES DES MANGANITES SPINELLES CUBIQUES NiMn SUB 2 0 SUB 4]

Bernard Boucher (Ph.D. Thesis - Paris Univ., 2 Dec. 1968) Jul. 1969 104 p (France). In FRENCH, ENGLISH summary

(CEA-R-3806) Avail: CFSTI

Variation of the crystallographic properties (inversion degree, position parameters and short range order) of the cubic spinel Mn NiO. as a function of thermal treatment was investigated. Samples with Nu in the range 0.74 to 0.93 were used and it was found that the slower the sample is cooled the more inverse it is. It is shown, using molecular field theory, that a system of three magnetic sublattices can take up a star configuration and the conditions of stability of such a structure were established and its changes with temperature were forecast. Neutron diffraction measurements showed that the magnetic structure of NiMn O at 4.2 has a star configuration and that with increasing temperature it becomes a collinear structure in agreement with the theory. An anomaly in the value of the specific heat at the transition temperature between star and collinear structures is discussed. Author (ESRO)

N70-17523*# California Univ., Santa Barbara.

ULTRAVIOLET SOLID STATE SPECTROSCOPY IN THE SPECTRAL REGION 3000 – 300 A Final Report, 1 Oct. 1960 – 1 Dec. 1969

William C. Walker 1 Dec. 1969 10 p refs

(Grant NGR-05-010-001)

(NASA-CR-107877) Avail: CFSTI CSCL 20L

A summary of research in solid state spectroscopy on a variety of materials of interest to both ultraviolet optics and solid state physics is reported. The most significant results of the research are considered to be: (1) a detailed understanding of the interband spectra of several alkali halides and alkaline earth oxides for which the correlations were made of spectral data and empirical psuedopotential band structure calculations in ionic solids; (2) observations of exciton-phonon bound states in alkaline earth oxide spectra; (3) observation of valence band, spin-orbit splitting in metal oxides; (4) development and early use of polarizers for far ultraviolet spectroscopy; and (5) evaluation of the optical constants of a variety of ultraviolet optical materials above the fundamental absorption edge. Author

N70-17528*# Illinois Univ., Urbana.

APPLIED PHYSICS

R. N. Peacock, G. E. Anner, R. Birtcher, W. P. Bleha, J. W. Culton et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 47 – 84 refs (See N70-17526 08-34)

(Contract DAAK02-67-C-0546)

Avail: CFSTI CSCL 20L

Resistivity and mobility data as a function of temperature, and photoluminescent spectra are given for vacuum deposited CdS films about one micron thick. Measurements on metal – insulator – CdS structures show light emission at voltages as low as one volt, making a tunnel injection mechanism doubtful. Parameters are discussed for experimental measurements of barrier heights in tunneling experiments. The behavior of an omegatron total – partial pressure gauge is discussed, as well as the effect of small magnetic fields on typical ionization gauges. The scanning electron microscope was used to examine surfaces prepared by electrical – discharge machining. The results have led to cutting conditions improving the rate, and reducing surface damage. Author

N70-17533*# Illinois Univ., Urbana.

SEMICONDUCTOR PHYSICS

W. D. Compton, B. Arora, D. E. Cullen, T. E. Jones, E. S. Johnson et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 148 – 184 refs (See N70-17526 06-34)

Avail: CFSTI CSCL 20L

Defects and impurities determine many of the properties of semiconductors. In many cases, radiation offers a convenient means of introducing defects. Results are presented of the influence of irradiation upon the recombination luminescence of silicon, the luminescent spectra of CdSe when excited into laser action, and the electrical properties of p – i – n diodes. The tunneling between metal – semiconductor junctions is investigated as a function of the impurity level in the semiconductor. Author

N70-17556# Israel Atomic Energy Commission, Tel Aviv.
PHASE TRANFORMATIONS IN REFRACTORS OXIDE FILMS UNDER ELECTRON-BEAM HEATING
A. Aladjem, D. G. Brandon, J. Yahalom, and J. Zahavi May 1969 32 p refs
(IA-1189) Avail: CFSTI

Refractors oxide films were prepared by anodic oxidation of pure aluminum, titanium, niobium, tantalum, and tungsten and examined by direct transmission electron microscopy. Phase transformations were induced in the film by electron beam heating in the microscope, and the crystalline phases formed were identified. With the exception of titanium and zirconium oxides, the films were amorphous in the as formed state. The defect structure of the crystallized phases and the mode of crystallization were different for each oxide and specific for the given oxide. Author (NSA)

N70-17583# Kharkov State Univ. (USSR).
MAGNETORESISTIVITY AND HALL EFFECT IN PLASTICALLY DEFORMED SEMICRYSTALLINE BISMUTH IN WEAK MAGNETIC FIELDS
G. A. Zaytsev, V. P. Slyusar, and V. I. Khotkevich *In* Akad. Nauk Investigating the Electron. Properties of Metals and Alloys 1967 p 68–71 refs In RUSSIAN (See N70-17576 06-17)
Avail: CFSTI

Experimental verifications are discussed for application of the symmetry principle of kinetic coefficients to magnetic resistance and Hall effect measurements for plastically deformed bismuth in a weak magnetic field. It is shown that the presence of a large number of post-deformation crystal lattice defects does not qualitatively change the form of the observed relationships for the magnetic resistance and the Hall effect. Data are presented for the magnetic resistance and its analog for differences in the Hall effect dependent on magnetic field strength. Deformation by compression up to 14 percent attests to the insignificant change in the concentration of quasiparticles and to the isotropic effect of crystal lattice defects on the length of the free path of electrons. Transl. by H.W.

N70-17588# Kiev Univ. (USSR).
THE EFFECT OF CRYSTALLINE STRUCTURE DEFECTS ON THE ANISOTROPY OF THE WIDTH OF THE FERROMAGNETIC RESONANCE LINE
I. A. Deryugin and V. V. Danilov *In* Akad. Nauk Investigating the Electron Properties of Metals and Alloys 1967 p 103–106 refs In RUSSIAN (See N70-17576 06-17)
Avail: CFSTI

The anisotropy was investigated for the ferromagnetic resonance line width of spherical mono-crystalline specimens of yttrium-ferrite garnet, oriented in the (110) plane. The general increase in anisotropy as a result of annealing is explained by an increase in the depth of the distorted layer around the surface; certain changes in the character of the anisotropy are apparently caused by recrystallization. A polished ferrite sphere will have heterogeneous surface machining, which leads to a noticeable anisotropy of the ferromagnetic resonance line width. During prolonged finely dispersed abrasive polishing a widening of the line is sometimes observed. Metallographic studies of such specimens show the presence of surface flaws of up to 5 mk, evidently due to the fatigue destruction of the layer around the surface from varing loads and the accumulation of defects during the polishing process. Transl. by H.W.

N70-17589# Akademiya Nauk URSR, Kiev.
THE NATURE OF THE INTRAATOMIC REACTION AND ELECTROSTATIC POTENTIAL IN THE KCl LATTICE
K. I. Gorokhov, V. P. Tsvetkov, and L. V. Shevtsov *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 107–116 refs In RUSSIAN (See N70-17576 06-17)
Avail: CFSTI

X-ray studies were conducted using powdered chemically pure salt. Potential energy along three basic directions in the KCl lattice was characterized by a distribution of the potential around each of the ions which lacked spherical symmetry. The distribution of the potential energy has specific forms agreeing with the character of the forces in a given direction. The different character of the potential energy distribution in the KCl lattice completely corresponds to the distribution of attraction and repulsion forces in the ion crystal. Investigations using potential energy curves are found to be more effective for determining chemical bonding properties in crystals than those based on electron density distribution measurements. Transl. by H.W.

N70-17592# Odessa Polytechnic Inst. (USSR).
INVESTIGATING THE ELECTRICAL CONDUCTIVITY OF FILMS OF CHROMIUM SILICON IN THE CRYSTALLIZATION PROCESS
A. I. Sokolenko and I. B. Staryy *In its* Investigating the Electron. Properties of Metals and Alloys 1967 p 130–134 refs In RUSSIAN (See N70-17576 06-17)
Avail: CFSTI

Changes of the electrical conductivity and the structure of chromium silicon films were studied in the process of their crystallization during heat treatment. A comparison of the data from X-ray analysis, the electrical conductivity, the change of the Hall constant and of the sign of thermoelectromotive force led to conclusions about the mechanism of conductivity of chromium silicon films used as conducting elements in nonwire radio resistors. The X-ray studies show that, in freshly pulverized films and in films which underwent heat treatment in vacuum or in air up to 350 C, amorphic or high dispersed substances are dealt with, which have a complex composition of metal and silicon. The negative sign of the temperature factor of resistance suggests that the semiconductor character of the electrical conductivity of chromium silicon film after heat treatment and a positive Hall constant are indicative of hole conductivity. Transl. by H.W.

N70-17915 Maryland Univ., College Park.
MICROWAVE SURFACE IMPEDANCE OF METALS IN WEAK MAGNETIC FIELD: NORMAL STATE AND SUPERCONDUCTING STATE
Chen-Chi Kuo (Ph.D. Thesis) 1967 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-7231

The microwave surface impedance of several metals in a magnetic field below about 100 Oe is discussed. The samples were made from high purity single crystals. The range of the microwave frequency is 28 Gc/sec to 60 Gc/sec. In their normal state the samples of tin, indium and aluminum show oscillatory variations in the power absorption with respect to H, magnetic field, in the range 0 to 100 Oe. From the orientation dependence and the frequency scaling of the maxima of the resistance derivative peaks were identified as members of several series. The frequency scaling of the maxima has been investigated. An explanation of the normal state weak magnetic field effects of the microwave surface impedance has been obtained. Other properties of the low field effects are intimately related to the geometry of the electron Fermi surface of the metals. There is much evidence indicating that the signal is due to electrons on the cylindrical sections of Fermi surface. Dissert. Abstr.

N70-18010 Pennsylvania Univ., Philadelphia.
SUPERCONDUCTIVITY IN THIN FILMS OF TUNGSTEN
Suryadevara Basavaiah (Ph.D. Thesis) 1968 189 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-5606

Evaporated tungsten films were found to have a superconducting transition temperature, T sub c, of 3.2 K as compared to the bulk value of 0.01 K. Structural study of the electron beam evaporated W films was carried out by both X-ray and electron diffraction techniques. It was found that films prepared at pressures > 10 to the minus 7th power torr, and evaporation

rates <30 A/min. are a mixture of both alpha and beta phases, the beta phase being the A15 structure, and the alpha-phase being the BCC structure. It was established that the enhancement in T sub c of these films is due to the presence of the beta phase. Films prepared at 3 × 10 to the minus 9th power torr are pure alpha-W and they did not superconduct down to 1 K. The superconducting energy gap alpha-W of the beta-W films prepared at 5 × 10 to the minus 6th power torr and 25 A/min. was determined by tunneling in W-B-M junctions, where B is the plasma grown oxide barrier on W and M stands for Sn, Pb, and Au counterelectrodes. Dissert. Abstr.

N70-18100 Southern Methodist Univ., Dallas, Tex.
THE CHARACTERIZATION OF FAST-NEUTRON RADIATION-INDUCED TRAPS IN SILICON BY THE USE OF SPACECHARGE-LIMITED CARRIER INJECTION
Homan Thurman Henderson (Ph.D. Thesis) 1968 217 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-5519

A dramatic trap-filled limit characteristic has been observed in neutron irradiated silicon at 77 K, preceded by a distinct Ohm's law region. The experimental results from two bounding sides of Lampert's triangle in a logarithmic voltampere plot, wherein all conduction possibilities in solids are theoretically confined (at constant mobility). Independent methods of determining the extrapolated intersection of Child's trap-free square law with the Ohm's law region and the TFL voltage, fit the experimental pattern very well. The oxygen vacancy A-center complex, was identified as the trap responsible for the TFL behavior at 77 K. It was found that appropriate room temperature contacting and surface state band-bending can be achieved in high resistivity, irradiated silicon, which will function well to liquid nitrogen temperatures. The results suggest that space charge limited carrier injection can be a powerful tool in the definition of radiation defects in semiconductors. Dissert. Abstr.

N70-18131 Purdue Univ., Lafayette, Ind.
HOP CONDUCTION IN GERMANIUM AT HIGH MAGNETIC FIELDS
Jan A. Chroboczek (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-7432

The transverse magnetoresistance of phonon assisted hop conduction was studied in P-doped and Ga-doped Ge by means of a dc technique, and in P-doped and Sb-doped Ge by means of an ac technique. The experimental dependence of the dc magnetoresistance of P-doped Ge at 4.2 degree K on the strength and orientation of the magnetic induction up to 78 kG was compared with predictions based on an extension of the theory of Moikoshiba, adapted to the multicomponent donar wave function. An attempt was made to compare the experimental temperature dependence of the ac magnetoresistance of n-type Ge with that predicted by the theory of spin flip hopping for values of the frequency and magnetic induction at which spin flip transitions should dominate. The satisfactory agreement that is obtained indicates that spin flip transitions contribute to hop conductance at high magnetic fields. Dissert. Abstr.

N70-18186# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
METHOD OF INVESTIGATING PIEZOTHERMAL emf OF SEMICONDUCTORS [METODIKA ISSLEDOVANIA P'YEZOTERMO EDS POLUPROVODNIKOV]
I. M. Pilat and Zh. K. Pankratova 1968 6 p refs Transl. into ENGLISH from Ukr. Fiz. Zh., (USSR), v. 13, no. 4, 1968 p 577-579 Prepared for MIT
(AZT-69-500-RULL) Avail: CFSTI

A technique is described for investigating the piezothermoelectromotive force by the method of uniaxial static pressure in a wide range of stresses at temperatures higher than room temperature. The results of measurements are given for the n-Ge piezothermoelectromotive force under stresses of 0 to 5 × 10 to the ninth dyn/sq cm and over the temperature range 20 to 140 C. Author

N70-18188 Pennsylvania State Univ., University Park.
THE THIRD ORDER ELASTIC COEFFICIENTS AND SOME ANHARMONIC PROPERTIES OF ALUMINUM OXIDE
John Herman Gieske (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-5547

The ultrasonic wave velocities in suitably oriented single crystals of Al2O3 and in polycrystalline Al2O3 were measured at room temperature by the pulse superposition method as functions of hydrostatic and uniaxial compression. Equations relating these measurements to linear combinations of the second and third order elastic coefficients are given. From these equations, the 14 third order elastic coefficients of the single crystal and the three third order elastic coefficients of the polycrystal were calculated by the method of least squares. Also, from the hydrostatic measurements, the isothermal pressure derivatives of the effective second order adiabatic constants were calculated by the method of least squares. Orientational dependence of the theoretical strength for brittle fracture, test of the Voigt-Reuss-Hill average for the third order elastic coefficients, and calculation of elastic Grueneisen parameters on the basis of an anisotropic continuum model as a function of temperature were determined. The same order of magnitude as values obtained experimentally for submicron-size Al2O3 whiskers. For Al2O3, the Voigt-Reuss-Hill averages differ from the experimental values by the following amounts: for C sub 111, 1.4 percent; for C sub 112, 10.2 percent; and for C sub 123, 9.4 percent. The calculated elastic Grueneisen parameters differ from the values calculated from thermal data by five percent from room temperature up to 1000 K. Below room temperature, the agreement is poor. Dissert. Abstr.

N70-18189# General Post Office, London (England). Research Dept.
DIRECT NITRIDATION OF THE Si(III) SURFACE: A LOW ENERGY ELECTRON DIFFRACTION STUDY, OCTOBER 1967 - DECEMBER 1968
R. Heckingbottom and M. A. G. Halliwell Dec. 1968 17 p refs (Rept-61) Avail: CFSTI

Silicon nitride is currently being considered as the insulator in metal-insulator-silicon integrated circuits. Unfortunately the amorphous nitride films grown by chemical vapor deposition form an Si3N4/Si interface which develops a high, and time-variable, charge density under conditions of normal device operation. Investigation of the thermal nitridation of the Si(111) surface in ammonia and nitrogen using low energy electron diffraction (LEED) as the primary experimental technique is described. The LEED was used to provide information about the structure of the substrate surface and of the nitride layers at the interface, as they formed. It was found that between 700 C and 1200 C the initial nitridation resulted in the growth of ordered layers which showed a definite epitaxial relationship with the silicon substrate. Continued nitridation led to more irregular growth of nitride, which has so far prevented electrical assessment of the interface. Author

N70-18202# Cornell Univ., Ithaca, N.Y. Materials Science Center.
ELECTRICAL CONDUCTIVITY IN PURE TYPE-2 SUPERCONDUCTORS NEAR H SUB C2
William David Hibler, III (Ph.D. Thesis) Sep. 1969 173 p refs (Contract N00014-67-A-0077)
(AD-696129; MSC-TR-7) Avail: CFSTI CSCL 20/3

The electrical conductivity for pure type-II superconductors for magnetic fields near H sub(c2) was calculated. The calculation is carried out in the extreme pure limit for frequencies and relaxation times such that omega tau > 1. The conductivity in the absence of fluctuations, i.e. with a static vortex lattice, is calculated in a manner similar to the procedure used by Brandt, Pesch and Tewordt to obtain the density of states. In particular the off-diagonal

elements in the Gorkov factorization are determined by using the Gorkov integral equations and the response function is shown to have the periodicity of the lattice of fluxoids in the center of mass co-ordinates. Using this periodicity, an expression for the response function may be obtained. Author (TAB)

N70-18233 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE SPECIFIC HEAT OF n AND p TYPE BISMUTH TELLURIDE, BISMUTH SELENIDE, AND PLATINUM FROM 1.4 TO 90 K
Gary Edward Shoemake (Ph.D. Thesis) 1968 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-6587

Measurements were taken for high purity platinum and high purity copper. A standard calorimeter incorporating a mechanical heat switch and germanium thermometer is used for all measurements. From this work, it is found that at low temperatures there exist measurable differences in the electronic specific heats of n-type Bi2Te3. These differences can be explained on the basis of a six-ellipsoid model for the conduction band, provided an additional heavy mass band is assumed as postulated originally to explain the carrier density dependence of the dHvA effect in n-type Bi2Te3. The electronic specific heat of p-type Bi2Te3 is consistent with a six-ellipsoid model. For both n- and p-type Bi2Te3, as well as Bi2Se3, departure of the lattice specific heat from the Debye T(3)approximation begins well below the lowest temperatures measured. Dissert. Abstr.

N70-18234# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SOLUBILITY OF SODIUM IN LEAD TELLURIDE
Ye. D. Nesberg et al May 1969 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (USSR), v. 5, no. 2, 1969 p 374–375 Sponsored by MIT, Lincoln Lab.
(Rept-171-69-392-RULL) Avail: CFSTI

The thermal stability of lead telluride doped with sodium was investigated. In samples annealed at 570 K, the concentration of current carriers are shown to increase after annealing at 970 K, as a result of dissolving the excess sodium. Zone leveled monocrystalline and polycrystalline samples prepared by the addition of sodium and tellurium in a 1 to 1 ratio were utilized for determining the coefficient of distribution. It is concluded that in lead telluride deeply doped with sodium the concentration of current carriers may vary reversibly as a function of temperature. F.O.S.

N70-18235# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PHOTOMETRIC METHODS OF DETERMINING MICROIMPURITIES IN COMPOUNDS OF A(II)B(VI) TYPE
R. P. Pantaler et al May 1969 10 p refs Transl. into ENGLISH from Tr. Komis. Po Analit. Khim, Akad. Nauk SSSR (Moscow), v. 16, 1968 p 24–29 Sponsored by MIT, Lincoln Lab.
(Rept-179-69-406-RULL) Avail: CFSTI

Photometric methods for determining microimpurities of the materials of A(ii)B(vi) type are presented. The allowable impurities in the sulfides and selenides of cadmium and zinc used for semiconductor materials are shown to be less than 0.00001. The methods for the determination of copper, nickel, iron, manganese gallium, and indium in sulfides are presented. F.O.S.

N70-18262# Aztec School of Langueges, Inc., Maynard, Mass. Research Translation Div.
EXCHANGE INTERACTION THROUGH CONDUCTION ELECTRONS IN EuO DOPED WITH GADOLINIUM
A. A. Samokhvalov et al May 1969 4 p refs Transl. into ENGLISH from Fiz. Tverd. Tela (Leningrad), v. 11, no. 2, 1969 p 483–484 Sponsored by MIT, Lincoln Lab.
(Rept-180-69-406-RULL) Avail: CFSTI

Ferromagnetic conductors and dielectrics on a base of bivalent europium were investigated to determine the effects of the exchange interaction on energy. The ferrodielectrics show a pronounced change in the energy of the exchange interaction due to a lack of current carriers. R.B.

N70-18263# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SYNTHESIS AND DIRECTED CRYSTALLIZATION OF CADMIUM TELLURIDE WITH CONTROLLED DEVIATION FROM STOICHIOMETRY
S. A. Medvedev et al May 1969 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (RUSSIAN), v. 4, no. 11, 1969 p 2025–2027 Sponsored by MIT, Lincoln Lab.
(Rept-168-69-389-RULL) Avail: CFSTI

A technique is described for synthesizing cadmium telluride which permits control of the type and value of crystal conductivity. The effects of original component purity on the mobility of the carriers in n- and p-type CdTe are investigated. To obtain pure n-type CdTe with a given conductivity, single crystals are grown under cadmium vapor pressures which exceed the equilibrium partial pressure of dissociation at the temperature of crystallization. R.B.

N70-18264# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
GROWING SINGLE CRYSTALS OF GaSe BY THE METHOD OF GAS-TRANSPORT REACTIONS
T. Kh. Azizov May 1969 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Mat. i Tekhn. Nauk (Baku), no. 3, 1968 p 26–28 Sponsored by MIT, Lincoln Lab.
(Rept-167-69-388-RULL) Avail: CFSTI

A method is discussed for producing single crystals of gallium selenide and conditions are described for the optimal growth cycle of the crystal as a function of the amount of the carrier. The dependence of the transport rate on the amount of original material, the temperature gradient, and the time is investigated. Radiographic inspection of GaSe by the monocrystalline method shows that the crystal lattice does not depend on the method of production and that it retains a hexagonal symmetry. R.B.

N70-18277# University of Southern Calif., Los Angeles.
RESEARCH INITIATION. GRAIN GROWTH IN CERAMICS Final Report
[1970] 22 p refs
(Grant NSF GK-1487)
Avail: Issuing Activity

The importance of keeping porosity attached to grain boundaries in the achievement of dense bodies by sintering is discussed. The interdependence of grain growth and sintering by considering the microstructural situations that lead to pore attachment is described. This description leads to an interpretation of the role of sintering additives, and criteria for the selection of additives are suggested in light of the interpretation. Experiments related to the problem are described. Author

N70-18302# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF GAMMA RADIATION ON THE MICROHARDNESS OF Ge AND Si SINGLE CRYSTALS
J. K. Kaipnazarov et al 5 Sep. 1969 7 p refs Transl. into ENGLISH from Izd-Vo Fan, Tashkent, (USSR), 1967 p 29–31
(AD-696318; FTD-HT-23-397-69) Avail: CFSTI CSCL 20/12

The dependence of the microhardness of materials on such factors as the extent of perfection of crystal lattices, degree of purity of the samples, and the condition of the surface is studied. Results on the effects of gamma-irradiation on the microhardness of single crystals of Ge and Si are reported. It is shown that the magnitude of hardness obeys a given formula. Curves are plotted of: (1) relative fluctuation of microhardness versus the gamma-ray dosage; (2) isothermic annealing of defects generated by gamma-ray irradiation for various temperatures, and (3) variation of the logarithm of the annealing time for a definite fraction of defects versus the temperature. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-17254# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
SPECIFICATION DRAFT FOR THE SUPPLY OF DISSYMMETRICAL DIMETHYLHYDRAZINE: OPERATION MODES [PROJET DE CAHIER DES CHARGES POUR LA FOURNITURE DE DIMETHYLHYDRAZINE DISSYMETRIQUE: MODES OPERATOIRES]
29 Sep. 1969 36 p In FRENCH
(LRBA-NT-75/63/SET/EP) Avail: CFSTI

The modes of operation governing the analysis of dimethylhydrazine are discussed, and tests, including the determination of densities, optical transmission ratio, and distillation ratio and dosage, are described. ESRO

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-16915*# TRW Systems, Redondo Beach, Calif. Science and Technology Div.
INVESTIGATION OF THRUSTORS FOR CRYOGENIC REACTION CONTROL SYSTEMS Monthly Progress Report 28 Jun. - 25 Jul. 1969
R. J. Johnson 25 Aug. 1969 17 p
(Contract NAS3-11227)
(NASA-CR-107658; MPR-14) Avail: CFSTI CSCL 21H

This program is comprised of an experimental and supporting analytical evaluation of the ignition delay, reactor design, thrustor response times, and delivered performance for a gaseous hydrogen oxygen reaction control thrustor. Design criteria was established for a pilot bed catalytic reactor capable of igniting a gaseous hydrogen oxygen thrustor. An operating map was defined for reliable thrustor ignition and operation, including the operating variables of propellant temperatures, propellant inlet pressures, vacuum effects, and catalyst bed temperature. Author

N70-17204*# National Aeronautics and Space Administration Washington, D.C.
LAUNCHING OF SERT 2
25 Jan. 1970 8 p
(NASA-News-Release-70-8) Avail: NASA Scientific and Technical Information Division CSCL 21C

Electron-bombardment ion engines and experiments to be performed by SERT 2 are described. A circular orbit 621 miles above the earth inclined 99.1 degrees to the equator is planned for the first orbital test of ion engines. The SERT 2 engines generate thrust by ionizing a vaporized mercury propellant, electrically accelerating the ions, neutralizing, and expelling the ions at extremely high speeds. Operating characteristics and reliability of an ion engine will be observed during six month continuous operation in the space environment. Spacecraft-earth radio communications, electrical compatability of the thruster system, and effects of exhaust products on solar cells, thermal control, and optical properties of surfaces will be studied. J.M.

N70-17288*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
EVALUATION WITH A TURBOFAN ENGINE OF AIR JETS AS A STEADY-STATE INLET FLOW DISTORTION DEVICE Technical Memorandum
Willis M. Braithwaite, John H. Dicus, and John E. Moss, Jr. Washington Jan. 1970 29 p refs
(NASA-TM-X-1955; E-5325) Avail: CFSTI CSCL 21E

An experimental program was conducted to evaluate the effectiveness of the secondary air jet distortion device. This system is compared with the conventional screens as a means of creating a 180 deg distortion. The results are presented as engine stall limits and inlet profiles. The two systems produced essentially equivalent distortion profiles at a Reynolds number index of 0.5. The stall-limited distortions, determined with screens and air jets, were in good agreement. Author

N70-17419*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ANALYTICAL HEAT TRANSFER INVESTIGATION OF INSULATED LIQUID METHANE WING TANKS FOR SUPERSONIC CRUISE AIRCRAFT
Eugene J. Pleban Washington Jan. 1970 37 p refs
(NASA-TN-D-5641; E-5258) Avail: CFSTI CSCL 21E

Liquid methane boiloff from wing tanks was computed for typical SST missions for cruise Mach numbers of 2.7, 3.0, 3.5, insulation thicknesses varying from 0.5 to 2 in. (1.27 to 5.08 cm), various vent pressure settings, and saturated and subcooled fuel. Boiloff rates during fuel fill and ground hold are discussed. Boiloff losses less than 1-1/2 percent are possible for cruise Mach numbers up to 3.5 for an insulation thickness of 1 in. (2.54 cm). Author

N70-17470*# United Aircraft Corp., East Hartford, Conn.
INVESTIGATION OF GASEOUS NUCLEAR ROCKET TECHNOLOGY Summary Technical Report, 15 Sep. 1963 - 15 Nov. 1969
G. H. Mc Lafferty Nov. 1969 139 p refs Sponsored in part by AEC
(Contract NASw-847)
(NASA-CR-107869; H-910093-46) Avail: CFSTI CSCL 21F

A feasibility study was made of a gaseous nuclear rocket engine concept: the closed-cycle nuclear light bulb engine. The engine is based on the transfer of energy by thermal radiation from gaseous nuclear fuel suspended in a neon vortex through an internally cooled transparent wall to seeded hydrogen propellant. Such an engine offers the possibility of providing values of specific impulse greater than 1500 sec, values of thrust-to-weight ratio greater than 1, and containment of the gaseous nuclear fuel without loss of fuel or fission products in the exhaust from the engine. In addition, it may be possible to obtain many reuses from such an engine by replenishing the spent recirculating fuel. Removal of the spent fuel and fission products from the engine would also reduce the radiation hazards during multiple-rendezvous missions. The investigations include: the characteristics of one-component and two-component vortex flows; the characteristics of coaxial flows; the spectral and total radiant energy emitted from the fuel-containment region; the transmission characteristics of fused silica exposed to nuclear radiation. Author

N70-17476# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
BIBLIOGRAPHIES ON THE ROCKET-MOTORS [BIBLIOGRAPHIE SUR MOTEURS-TUSEES]
I. A. Doucet Sep. 1969 37 p refs In FRENCH
(LRBA-NT-81/69/SET/EP) Avail: CFSTI

A survey is presented of existing launch vehicles together with their performance and characteristics including those of exhaust nozzles, fuel pumps, and thrust at sea level. ESRO

N70-17604*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMODYNAMIC EFFECTS OF CAVITATION OF AN 80.6 DEG HELICAL INDUCER OPERATED IN HYDROGEN

Royce D. Moore and Phillip R. Meng Washington, D.C. Jan. 1970 13 p refs

(NASA-TN-D-5614; E-5248) Avail: CFSTI CSCL 21I

An 80.6 deg helical inducer was used to evaluate the thermodynamic effects of cavitation in liquid hydrogen over a range of liquid temperatures and flow coefficients at two rotative speeds. The magnitude of the predicted thermodynamic effects increased with both increasing liquid temperature and rotative speed and decreased with increasing flow coefficent. The measured values of net positive suction head were in good agreement with those obtained using a semiempirical prediction method. Author

N70-17908*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

PROGRESS IN THE ANALYSIS OF JET ENGINE BURST-ROTOR CONTAINMENT DEVICES

R. Bruce McCallum, John W. Leech, and Emmett A. Witmer Aug. 1969 174 p refs

(Grant NGR-22-009-339)

(NASA-CR-107900; ASRL-TR-154-1) Avail: CFSTI CSCL 21E

A FORTRAN IV computer program is presented, which can be used to predict the large two-dimensional elastic-plastic dynamic deformations of a free, nonuniformly heated circular ring subjected to an initial impulse loading followed by a time-dependent forcing function which could be defined to simulate the forces which result from the interaction of a burst-rotor blade and a containment ring. Provisions which account for temperature-dependent material properties and effects of temperature-induced thermal stresses are included. Temperature-dependent, strain-hardening, and strain-rate effects of the ring material are taken into account. In addition, a new method which uses measured ring position data obtained from high-speed motion picture film is proposed to calculate the approximate "external forces" acting on the ring caused by a fragment-ring interaction. The required accuracy in position measurements to obtain meaningful forces is presented together with resulting example forces. Author

N70-17954*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TECHNIQUE FOR INDUCING CONTROLLED STEADY-STATE AND DYNAMIC INLET PRESSURE DISTURBANCES FOR JET ENGINE TESTS

Carl L. Meyer, John E. McAulay, and Thomas J. Biesiadny Washington Jan. 1970 34 p refs

(NASA-TM-X-1946; E-5318) Avail: CFSTI CSCL 21E

Capabilities and limitations of a technique for inducing variable-amplitude steady-state or dynamic pressure distortions or dynamic uniform pressure oscillations for jet engine tests are illustrated. In the technique, secondary air was injected through an array of small nozzles uniformly distributed in an engine inlet duct to achieve momentum interchange with the primary air. Secondary-air distribution and flow rate were controlled. Author

N70-17957*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

METHOD FOR DETERMINING COMPONENT MATCHING AND OPERATING CHARACTERISTICS FOR TURBOJET ENGINES

David G. Evans Washington Jan. 1970 23 p refs

(NASA-TM-X-1945; E-5316) Avail: CFSTI CSCL 21E

Maps are developed for matching the compressor and turbine components of a single-spool engine. Component pressure ratios and engine temperature ratios are determined which satisfy the matching requirements of flow, power, and rotative speed. The method of development is primarily graphic in form. Operating lines are constructed which illustrate two modes of engine operation for two types of missions. Transient operation is also considered. Included is the effect of varying the nozzle throat area on matching the components. Author

N70-18079*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECT OF PLUG BASE CONTOUR ON PERFORMANCE OF A FULLY TRUNCATED PLUG NOZZLE WITH TRANSLATING SHROUD

Charles E. Mercer and Bobby L. Berrier Washington Feb. 1970 40 p refs

(NASA-TN-D-5655; L-6896) Avail: CFSTI CSCL 21E

An investigation of the effect of plug base contour on the thrust-minus-drag performance of a fully truncated plug nozzle with a simulated translating shroud has been conducted in a 16-foot transonic tunnel at static conditions and at Mach numbers from 0.50 to 1.30. Two plug base contours were used, namely, flat and semitoroidal. Author

N70-18146# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).

APPROXIMATE METHOD OF DETERMINING THE MINIMUM ALLOWABLE DISTANCE BETWEEN A NOZZLE AND A BARRIER [METHODE APPROCHEE DE CALCUL A LA DISTANCE MINIMALE ADMISSIBLE ENTRE UNE TUYERE ET UN OBSTACLE]

A. L. Isakov and V. I. Pogorelov [1969] 12 p In FRENCH and RUSSIAN Its Trans. of Higher Educational Inst. No. 3

(LRBA-69-045S) Avail: CFSTI

The limitation of the distance between the nozzle and a barrier in such devices as vertical takeoff aircraft is connected to the fact that, in certain positions, a shock wave is created which changes the flow inside the nozzle and the amount of jet power. A simple method is presented for determining the distance at which this phenomenon occurs in terms of the interaction between the jet and a plane obstacle. An increase in the pressure causes a decrease in the minimum allowable distance. This also occurs with an increase of the Mach number at the exit of the nozzle. A comparison of computed and experimental results shows satisfactory agreement; the separation was within the limits of precision as interpreted by shadow photography. Transl. by H.W.

N70-18165# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

STEP TYPE MOTOR REDUCER FOR OPERATION IN THE ULTRA-HIGH VACUUM OF SPACE [MOTO-REDUCTEUR PAS A PAS POUR FONCTIONNEMENT DANS L'ULTRAVIDE SPATIAL]

1968 9 p Transl. into ENGLISH from Sciences et Industries Spatiales, (French), v. 4, no. 910, 1968 p 33-34 Sponsored by MIT

(AZT-69-505-FRLL) Avail: CFSTI

Design problems and their solutions, and initial test results of the a step-type engine with reducer for satellites are described. Outgassing was reduced to a minimum by using polishes impregnated under a forced vacuum. Lubrication was considered impossible, and a copper alloy with hexagonal structure to withstand friction was chosen for gears. The absence of oxides which act as a protective coating and a lubricant is discussed. Because of the absence of cooling by convection, it was decided to feed the engine with a minimum of energy and to have minimal drag parasite torques. The engine-reducer device was tested under vacuum conditions for a periods corresponding to six months and to three years of use in space. Minimal damage was noted. N.E.N.

N70-18191 Northwestern Univ., Evanston, Ill.

FUEL OPTIMAL RENDEZVOUS CONTROL

Edward Arthur Euler (Ph.D. Thesis) 1968 108 p

Avail: Univ. Microfilms; HC $5.40/Microfilm $3.00 Order No. 69-6920

A study is made of the coplanar rendezvous maneuver between a thrusting vehicle and a passive vehicle in an elliptic orbit. In the terminal phase of rendezvous, where the equations of relative motion can be linearized, an analytic solution for the fuel optimal control is found for both low thrust and impulsive vehicles. The linearization is made in two different coordinate systems, but the calculations are carried out in polar coordinates. If the initial position and velocity are outside of the range of the linear analysis, a perturbation expansion in terms of a small combination of initial conditions is made to account for the nonlinear effects of the motion. When the second-order terms are included in the analysis, an approximate fuel optimal low thrust program is found which is close to the exact numerical optimal control for certain initial conditions. The exact numerical optimal control is obtained for any initial conditions by a simple iteration scheme. Dissert. Abstr.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-16961*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAPPED PROTONS > OR = 100 KeV AND POSSIBLE SOURCES
D. J. Williams Jan. 1970 30 p refs
(NASA-TM-X-63797; X-640-70-9) Avail: CFSTI CSCL 04A

The general characteristics of the trapped greater than or equal to 100 keV population, the principal time variations observed, and the status of major source and transport mechanisms with primary emphasis on diffusion by violation of the third adiabatic invariant are considered. Author

N70-17045*# Iowa Univ., Iowa City.
RESEARCH IN SPACE PHYSICS
J. A. Van Allen 6 Oct. 1969 27 p refs
(Grant NGL-16-001-002)
(NASA-CR-107791) Avail: CFSTI CSCL 03B

Investigations to determine characteristics of corpuscular radiations in outer space and their relationships to electric, magnetic, and electromagnetic fields associated with the earth, the sun, the moon, the planets, and the interplanetary medium are reviewed. Emphasis was placed on the reduction and analysis of data from the sophisticated arrays of detectors flown on earth satellites and on planetary and interplanetary spacecraft. Analytical work involved processing of: (1) geomagnetically trapped radiation data from Injun 4, Explorer 14, and OGO satellites 1 through 5; (2) interplanetary particle measurements of Mariner 2, 4, and 5; and (3) solar X-ray data from Mariner 5 and Explorer satellites 33 and 35. Reduction and analysis of data from Injun 5 (Explorer 40) was begun. D.L.G.

N70-17122# Oxford Univ. (England). Clarendon Lab.
THE EARTH'S UPPER ATMOSPHERE: RADIATION AND RADIATIVE TRANSFER
J. T. Houghton Sep. 1968 59 p Presented at the ESRO Summer School, Frascati, Italy, Aug. 1967
(ESRO-SP-31) Avail: CFSTI

An outline is given of the absorption and emission of radiation including solar and thermal in the ultraviolet, visible, and infrared regions. Simple and approximate applications of the theory are made to a grey atmosphere, the upper stratosphere and mesosphere, and the lower thermosphere. In the discussion of transfer in the mesosphere, the breakdown of local thermodynamic equilibrium is taken into account. Author (ESRO)

N70-17208# McGill Univ., Montreal (Quebec). Faculty of Graduate Studies and Research.
ESTIMATING THE TOPOGRAPHIC VARIATIONS OF SHORT WAVE RADIATION INCOME: THE EXAMPLE OF BARBADOS
B. J. Garnier and Atsumu Ohmura Oct. 1969 76 p refs
(Contract N00014-68-C-0307)
(AD-696697; TR-1) Avail: CFSTI CSCL 4/2

The surface pattern of short wave radiation can be estimated from the observations of a single, representative site provided it is possible to distinguish between direct and sky-diffuse radiation totals. The patterns of direct radiation over an area can then be mapped from the observations normally taken on a horizontal surface, and a knowledge of (1) extra terrestrial radiation, (2) the latitude, and (3) the surface geometry of the given area. Sky-diffuse radiation can be mapped by reference to the observations normally taken and the angles of slope over the area. Application of these methods to Barbados with the aid of a computer mapping program shows how varied the seasonal patterns of short-wave radiation income can in fact be in a tropical region of moderately diverse relief, despite the general similarity of recordings on a horizontal surface. The method also brings out the importance of the first three hours of the day to the heating of east facing slopes. Author (TAB)

N70-17239# Rice Univ., Houston, Tex. Dept. of Space Science.
RESEARCH INTO AURORAL PHENOMENA Final Technical Report, Jun. 1965 - Jul. 1968
Brian J. O'Brien Jul. 1969 222 p
(Contract Nonr-4964(01))
(AD-696679) Avail: CFSTI CSCL 4/1

Principal accomplishments under the contract are: (1) the design, construction and successful use of the satellite Aurora 1, (2) advanced design, partial prototype construction and contractual planning of the satellite Aurora 2, and (3) the publication of numerous research papers, including such varied facets as a photometric survey of the night airglow over South America. Author (TAB)

N70-17243# Utah Univ., Salt Lake City.
HIGH-ENERGY NEUTRINOS IN THE UTAH APPARATUS
M. B. Hendricks, H. E. Bergeson, R. B. Coats, J. W. Keuffel, M. O. Larson et al 1969 11 p refs Presented at the 11th Intern. Conf. on Cosmic Rays, Budapest, 25 Aug.-4 Sep. 1969
Sponsored by NSF
Avail: CFSTI

In about 2500 sq meters ster days, 2 neutrino events have been observed in the Utah detector. Redundant information obtained concerning the muons involved indicates that, with a very high probability, both were moving upward. The rate is consistent with other underground experiments, but one of the muons has the surprisingly high energy of more than 45 GeV and probably more than 100 GeV. Author

N70-17319*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A SURVEY OF LOW-ENERGY (E GREATER THAN 5 keV) ELECTRON ENERGY FLUXES OVER THE NORTHERN AURORAL REGIONS WITH SATELLITE INJUN 4
J. D. Craven Jul. 1969 65 p refs
(Grant NGL-16-001-002; Contract Nonr-1509(08))
(NASA-CR-107842; Rept-69-40) Avail: CFSTI CSCL 04A

Observations of the energy fluxes of greater than or equal to 5 keV electrons at low altitudes (approximately 525 to 2500 km) over the northern auroral regions were made by the nearly polar orbiting Injun 4 satellite, from February 1965 through July 1968 during a period of minimum solar activity. Results of the first detailed survey of the percentages of occurrence of the energy fluxes of greater than or equal to 5 keV electrons in the outer radiation/auroral zone, as a function of magnetic local time and

invariant latitude, are graphically displayed for various energy flux thresholds. The greatest occurrences of these energy fluxes were observed in the night–dawn–morning hours of local time, at latitudes from approximately 65 deg to 70 deg. The spatial distributions of these contours are compared with those for the occurrences of optical auroras. Limited simultaneous observations of these energy fluxes at pitch angles of approximately 40 deg and approximately 90 deg showed that the ratios of these energy fluxes are typically greater than 0.1, with a condition of isotropy occurring for energy fluxes greater than or equal to 1 erg(sq cm-sec-sr) to the minus one power. Author

N70-17327# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
COSMIC RAY NEUTRON AND MUON MONITOR DIURNAL VECTORS, 1. FROM THE START-UP OF THE STATIONS TO THE END OF SOLAR ROTATION NUMBER 1812 AND VECTOR DIAGRAMS BY SOLAR ROTATION 19 JANUARY 1966
John F. Steljes Oct. 1969 81 p refs
(AECL-3479) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk: $2.00

Daily diurnal and semi-diurnal variation vectors for both muon and the neutron monitors are given in tabular form. The vectors are corrected for barometer and in the case of the muons for the atmospheric temperature wave using hourly values of the temperature and barometric pressure measured near the ground. Graphs of the vectors at each station for successive solar rotations are also given. Author

N70-17331# Utah Univ., Salt Lake City.
SEARCH FOR ANISOTROPIES IN THE UNDERGROUND MUON FLUX
S. C. Barrowes, H. E. Bergeson, M. O. Larson, J. L. Osborne, R. O. Stenerson, et al 1969 9 p refs Presented at the 11th Intern. Conf. on Cosmic Rays, Budapest, 25 Aug.–4 Sep. 1969 Supported by NSF
Avail: CFSTI

The arrival directions of 160,861 muons from primaries of energy about 10 to the 13th power eV were determined with resolution better than 1 deg. The resulting distribution was examined for anisotropies. No anisotropies of compelling significance were found. Author

N70-17393*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEQUENCE OF DIFFUSE PLASMA RESONANCES OBSERVED ON ALOUETTE 2 IONOGRAMS
Hirosha Oya Dec. 1969 18 p refs Submitted for publication
(NASA-TM-X-63804; X-615-69-542) Avail: CFSTI CSCL 04A

An investigation of more than 1400 Alouette 2 ionograms indicates that a sequence of diffuse plasma resonances exists and that these resonances are grouped according to plasma conditions. The time interval was separated into three periods in order to obtain a suitable variation of the plasma parameter at three telemetry stations chosen to cover the latitude range from –50 S to 65 N. Author

N70-17405# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
COSMIC RAY MT-64 MUON MONITOR DATA, 4. FROM SOLAR ROTATION 1840 TO ROTATION 1852 19 JANUARY 1968 to 3 JANUARY 1969
J. F. Steljes Nov. 1969 95 p refs
(AECL-3473) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $2.00

Hourly rates corrected for atmospheric temperature and pressure from four cosmic ray stations in Canada which have muon monitors maintained by AECL and from a survey monitor stationed at Kula, Hawaii are given in tabular form by solar rotation for the period from the beginning of Rotation 1840 to the end of Rotation 1852. The Dorman–Maeda temperature correction factors for each station calculated at 12 hour intervals from the radiosonde data of the Canadian Meteorological Branch or the US Weather Bureau are also listed. Barometric pressures are available from neutron monitor data reports already published. Graphs of the relative hourly rates at each station are given. Author

N70-17414# Utah Univ., Salt Lake City.
THE LATERAL DISTRIBUTION OF MUON SHOWERS DEEP UNDERGROUND
R. B. Coats, S. Ozaki, R. O. Stenerson, H. E. Bergeson, J. W. Keuffel et al Sep. 1969 8 p refs Presented at the 11th Intern. Conf. on Cosmic Rays, Budapest, 25 Aug.–4 Sep. 1969 Supported by NSF
Avail: Issuing Activity

The radial extent of muon showers underground has been studied by measuring the separations between 3,383 pairs of muons observed. The results are presented in the form of a decoherence curve which is compared to the theoretical predictions of Adcock, Wdowczyk, and Wolfendale. This comparison indicates that the mean transverse momentum of these shower muons is between 0.6 and 1.0 GeV/c. Author

N70-17440# Institut d'Aeronomie Spatiale de Belgique, Brussels.
MEASUREMENT OF THE STRATOSPHERIC ABSORPTION OF 3.05 TO 3.70 MUON SOLAR RADIATION [MESURE DE L'ABSORPTION STRATOSPHERIQUE DU RAYONNEMENT SOLAIRE DE 3.05 A 3.70 MICRONS]
M. Ackerman and D. Frimout 1969 13 p refs In FRENCH; ENGLISH summary Conf. presented at the Roy. Acad. of Sci., Brussels, 8 Nov. 1969 Submitted for publication *Its* Aeronomica Acta A-66-1969
Avail: CFSTI

Solar spectra have been recorded from 3.05 to 3.70 micrometers by means of a balloon borne monochromator at an altitude of 35 km and for solar zenith distances from 75 deg to 95 deg. Absorptions due to CH4 and H2O are identified as well as O3 bands observed for the first time in the atmosphere. Upper limits for the stratospheric mixing ratios of NO2 and HCHO are deduced. Author (ESRO)

N70-17448*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
A SURVEY OF THE TOTAL RADIATION IN SPACE OBSERVED BY THE OGO SATELLITES, 5 SEPTEMBER 1964 – 27 MAY 1968
S. R. Kane and J. R. Winckler Sep. 1969 210 p refs
(Contract NAS5-2071; Grant NGL-24-005-008)
(NASA-CR-107886; CR-135) Avail: CFSTI CSCL 04A

Graphical and tabular summaries of the ionization rates in space recorded by the large spherical ion chambers on the OGO-I and OGO-III spacecraft are presented. The survey begins with the launch of OGO-I in September, 1964 and ends with the last reduced data furnished on a regular basis by the Data Reduction Facility at Goddard Space Flight Center in May 1968 although some samples of data are given in July and August, 1968 from special runs. The ionization chambers are sensitive to all types of particle and photon radiation which can penetrate the aluminum shell. The hourly average rates of the ion chambers have been computed without regard to the location of the satellite and as a function of universal time for the entire period. Background radiation is measured outside the magnetosphere during periods of solar quiet. On each pass of the satellite the radiation belts are shown as large spikes with the radiation zones in general unresolved with the one hour averages and with the peak rates consistent with an average over this time period. Author

N70-17553# Addis Translations International, Woodside, Calif.
OBSERVED X-RAY EMISSION FROM THE CRAB NEBULA AND SKY BACKGROUND [OBSERVATION DU RAYNNEMENT X PROVENANT DE LA NEBULEUSE DU CRABE ET DU FOND DU CIEL]

G. Ducros et al Jul. 1969 22 p refs Transl. into ENGLISH of Saclay Nucl.-Res. Center, France preprint Prepared for California Univ., Livermore, Lawrence Radiation Lab.
(UCRL-Trans-10389) Avail: CFSTI

Results are presented of an astronomical experiment in the 2.5 to 30 keV x-ray energy range carried out in December 1968 aboard a rocket with an attitude-control system. The detectors were two proportional counters whose axes were aimed at the Crab Nebula and a point in the sky not in the galactic plane (RA 2 hr 24 min 30 sec, delta = −40 deg). Experimental findings are given. Author (NSA)

N70-17575# Kiruna Geophysical Observatory (Sweden).
PCA EVENTS OBSERVED AT KIRUNA IN THE YEAR 1968: DATA COLLOCATION
A. Theander, ed. [1969] 74 p Prepared jointly with European Space Sounding Rocket Range *Its* Geophys. Data, Suppl. to 69-1
Avail: CFSTI

The results of more or less continuous measurements carried out at Kiruna Geophysical Observatory, Sweden, and at ESRANGE, the nearby ESRO sounding rocket range and a collocation of recordings for seven of the PCA events which occurred during 1968 are presented. During the past few years the phase anomalies of VLF radio signals from US stations were the main source of PCA data. From such phase measurements it is possible to deduce approximate fluxes of solar protons of energies above 25 MeV and only PCA events for which the proton flux exceeded 0.5 protons/cm sec. ster. are included. Author (ESRO)

N70-17624*# Minnesota Univ., Minneapolis. Cosmic Ray Group.
DESCRIPTION OF DATA PLOTS FROM THE UNIVERSITY OF MINNESOTA ION CHAMBER AND ELECTRON SPECTROMETER ON OGO-1 AND OGO-3
S. R. Kane, K. A. Pfitzer, and J. R. Winckler Oct. 1969 40 p
(Contract NAS5-2071; Grant NGR-24-005-008)
(NASA-CR-107885; CR-147) Avail: CFSTI CSCL 04A

Samples of computer plots and their explanations are presented for electron spectrometer and ionization chamber data on radiation belts, solar radiation, and galactic cosmic rays. The electron spectrometer data are plotted against such factors as time, range, and L-values. All of the spectrometer data are plotted in the same arbitrary scale which must be multiplied by the conversion factor to obtain the electron fluxes or the differential energy spectra. The data for the five energy channels are background corrected and plotted against a normalized scale. A list of completed data plots is presented. J.M.

N70-17654*# Lockheed Missiles and Space Co., Palo Alto, Calif.
OPERATION OF A THREE-FREQUENCY RIOMETER SYSTEM ON THE NASA 711 AIRCRAFT DURING THE 1968 AURORAL EXPEDITION
J. N. Bradbury 15 Jan. 1969 32 p refs
(Contract NASw-1682)
(NASA-CR-107853; LMSC-N-83-69-1) Avail: CFSTI CSCL 04A

Auroral absorption events observed during the 1968 auroral expedition are discussed. The multifrequency riometer system is described, and data acquisition procedures and noise problems encountered are discussed. Absorption events are correlated with visual and photometric observations of the auroral conditions. D.L.G.

N70-17766# Department of Atomic Energy, Bombay (India). Cosmic Ray Committee.
PROCEEDINGS OF THE TENTH SYMPOSIUM ON COSMIC RAYS, ELEMENTARY PARTICLE PHYSICS AND ASTROPHYSICS
6 Apr. 1968 701 p refs Conf. presented at Aligarh, India, 12–16 Dec. 1967
(Conf-671217) Avail: AEC Depository Libraries

Conference papers pertain to primary cosmic radiation, cosmic rays as probes to study interplanetary conditions, extensive air showers and muons, astrophysics, and theories and experiments on elementary particle physics. For individual titles, see N70-17766 through N70-17867.

N70-17767# Tata Inst. of Fundamental Research, Bombay (India).
PROPAGATION OF COSMIC RADIATION IN THE INTERSTELLAR SPACE
M. V. K. Apparao *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 1–13 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Cosmic ray research is discussed with respect to its nature near the earth and its origin. Emphasis is given to modification of radiation during traverse from the source region to the edge of the solar system. The division of the chemical spectrum of the radiation into different groups is shown. The rare elements and isotopes of Li, Be, B, F, and He-3 are of particular interest to the study of cosmic ray propagation, because they are absent in likely sources of cosmic radiation and are produced by fragmentation of heavier nuclei. Mathematical models are constructed for the path length distribution of the radiation. R.B.

N70-17768# Tata Inst. of Fundamental Research, Bombay (India).
INTERSTELLAR H 2/He 4 AND He 3/He RATIOS IN COSMIC RAYS AND THE AMOUNT OF MATTER TRAVERSED AT LOW ENERGIES
S. Biswas and S. Ramadurai *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 14–18 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

The presence in cosmic rays of nuclei of He-3, H-2, Li, Be, and B provides information on the propagation of cosmic radiation through space. The regular model of cosmic ray propagation is discussed in which the mean amount of matter traversed by the radiation is taken as a parameter to determine the spectra incident at the earth. The variation of this parameter is determined with respect to energy and hence the interstellar spectrum of helium. R.B.

N70-17769# Tata Inst. of Fundamental Research, Bombay (India).
LITHIUM BERYLLIUM BORON AND FLUORINE NUCLEI IN COSMIC RADIATION
R. Cowsik, Yash Pal, S. N. Tandon, and R. P. Verma *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 19–23 refs (See N70-11766 06-29)
Avail: AEC Depository Libraries

It is proposed that the injection of cosmic rays into the interstellar medium could be continuous over periods much longer than the effective residence time of these particles in the galaxy so that the amount of matter traversed would have a very broad distribution. The spectral intensities of cosmic rays suffering fragmentation during traverse, energy losses due to ionization, and leakage during propagation relax to equilibrium values. The equilibrium flux of the cosmic ray nuclei at any energy is calculated by integrating the contribution from various times in the past. The results are displayed as the ratios of the fluxes of the daughter nuclei to those of their parents as functions of the kinetic energy per nucleon. R.B.

N70-17770# Tata Inst. of Fundamental Research, Bombay (India).
STEADY STATE SPECTRA OF PROTON AND HELIUM NUCLEI AND THEIR MODULATION
Yash Pal, S. N. Tandon, and R. P. Verma *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 24–27 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

The spectra of proton and helium nuclei are analyzed to provide direct information on solar modulation and injection spectra. The nuclei were calculated for three different injection spectra, i. e. power laws in total energy, rigidity, and kinetic energy, per nucleon. The information on modulation is compared with the results on relative modulation at different times and also on radial gradients of cosmic rays. The ratios of the calculated interstellar fluxes of protons and helium nuclei and their measured fluxes are plotted against two parameters of beta and R beta. R.B.

N70-17771# Tata Inst. of Fundamental Research, Bombay (India).
SPECTRA OF HEAVY AND SUPER HEAVY NUCLEI IN STEADY STATE
R. Cowsik, Yash Pal, S. N. Tandon, and R. P. Varma *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 28–32 refs (See N70-17766 06-29)
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Observations that the spectra of the iron group of nuclei do not relax below energies of 100 MeV/N and that nuclei with charges greater than or equal to 80 constitute a significant fraction of nuclei with charge greater than or equal to 36 necessitate analysis of steady state spectra in heavy nuclei. The results on the spectrum of the iron group of nuclei show that the experimental spectra are consistent with the assumption that those nuclei are injected with a source spectrum similar to that of M nuclei. The significant abundance of heavy hydrogen nuclei implies that in a slab model the slab thickness should be less than or equal to 1 gm/sq cm, which contradicts the value inferred from L/M ratio. It is concluded that if the results are confirmed by further observations the big bang model of the universe is invalid and interstellar matter can be replaced by a slab whose thickness is proportional to the average velocity of the particle proportional to the average velocity of the particle. R.B.

N70-17772# Punjab Univ., Chandigarh (India). Dept. of Physics.
CHARGE COMPOSITION AND ENERGY SPECTRA OF COSMIC RAY NUCLEI WITH Z = 10-28
V. S. Bhatia, V. S. Chonan, S. D. Pabbi, P. S. Kainth, and S. Biswas (Tata Inst. of Fundamental Res.) *In* Dept. of At. Energy Proc.of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 33–37 refs Supported by Dept. of At. Energy (See N70-17766 06-29)
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Determination of the charge in primary cosmic rays is made difficult due to saturation effects at high values of primary ionization. This difficulty is overcome by using the blob-gap parameter as a measure of the primary ionization. The results show that ionization values can be measured up to 1000 without regard to saturation effects. R.B.

N70-17773# Indian Inst. of Tech., New Delhi.
THE FLUX OF PRIMARY HELIUM NUCLEI NEAR HYDERABAD DURING 1965
R. K. Puri and P. K. Aditya *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 38–41 refs (See N70-17766 06-29)
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The alpha component of primary helium nuclei is particularly suitable for flux determination because of unambiguous identification due to its double electron charge, the absence of the reentrant splash albedo, and accurate extrapolation procedure from well known values of fragmentation and attenuation parameters. Results are presented from measurement of the energy spectrum and intensity of the alpha component during 1965 at Hyderabad, India. R.B.

N70-17774# Tata Inst. of Fundamental Research, Bombay (India).
RIGIDITY SPECTRUM OF COSMIC RAY HELIUM NUCLEI > or = 12 BV
K. C. Anand, R. R. Daniels, S. A. Stephens, B. Bhowmik, C. S. Krishna et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 42–43 refs (See N70-17766 06-29)
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The experiment utilized the variation of geomagnetic cut-off rigidity in the east-west plane over Hyderabad, India. Plots are given for the differential rigidity spectra of protons, alpha particles, and S-nuclei of the primary cosmic radiation at solar minimum. The flux values of protons above 5 BeV have been deduced from the integral values at the rigidities determined. The integral spectrum is constructed by calculating the cut-off rigidities over Guan at various arrival directions using the sixth degree simulation of the earth's magnetic field and normalizing the results of two other spectra measurements. R.B.

N70-17775# Tata Inst. of Fundamental Research, Bombay (India).
RIGIDITY SPECTRUM OF COSMIC RAY HELIUM NUCLEI USING A MAGNETIC SPECTROGRAPH
R. Cowsik, Yash Pal, S. N. Tandon, and R. P. Verma *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 44–47 refs (See N70-17766 06-29)
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Maximum detectable rigidities have been limited to approximately 1 GeV because of the size limitation on small magnets carried in balloon-borne experiments. An experiment is described in which the momentum spectra of helium nuclei are measured up to a rigidity of approximately 100 GeV by increasing the spatial resolution in the measurement of particle trajectories. R.B.

N70-17776# Tata Inst. of Fundamental Research, Bombay (India).
SPLASH ALBEDO MEASUREMENTS OVER HYDERABAD (LAMBDA = 8 DEG GEOMAGNETIC N)
P. K. Kunte, R. Sunderarajan, and G. S. Gokhale *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 48–51 refs (See N70-17766 06-29)
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An inverted double scintillator-Cerenkov counter telescope surrounded by an anti-coincidence shield was used to study the flux of splash albedo over Hyderabad, India. The cross plots are given for single particles from the east direction. From the cross plots, the flux values of relativistic singly charged particles are evaluated for the pure and shower events. R.B.

N70-17777# Physical Research Lab., Ahmedabad (India).
ON THE RIGIDITY SPECTRA OF TOTAL PRIMARY COSMIC RADIATION
K. Kasturirangan and N. W. Nerurkar *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 52–56 refs (See N70-17766 06-29)
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A method is described to derive the primary rigidity spectra of total cosmic radiation from observations made with balloon-borne detectors while ascending or descending in the atmosphere. The method is a modification of an earlier one and is based on the fact that as a detector ascends in the atmosphere, its mean energy of response changes to lower values, scanning the primary spectra in a manner analogous to conducting a latitude survey. R.B.

N70-17778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPOSITION OF THE 2nd SEPTEMBER 1966 SOLAR PARTICLE EVENT
C. E. Fichtel, D. E. Guss, D. V. Reames, and N. Durgaprasad (Tata Inst. of Fundamental Res.) *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 57–60 refs (See N70-17766 06-29)
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The charge composition of the solar particles emitted in solar flares was studied in detail during 1960 and 1961 with nuclear emulsion detectors flown in balloons and rockets. The results show that although the proton to helium nuclei ratio varied with time in a single event and from event to event, the relative abundances of the multiply charged nuclei are similar in all the events. A rocket sounding program is described for comparing the previous results with a type 3 flare of 2 Sep. 1966. It is concluded that the acceleration mechanism of solar cosmic rays does not appreciably alter the observed abundance of the solar photosphere. R.B.

N70-17779# Tata Inst. of Fundamental Research, Bombay (India).
SOLAR NEUTRONS
George Joseph *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 61–69 refs (See N70-17766 06-29)
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The theoretical and experimental status of production and detection of solar neutrons is discussed. A summary is given of balloon-borne experiments carried out near the geomagnetic equator. Plans are described for measuring the low energy component of neutrons at equatorial latitudes using balloon-borne proportional counters. R.B.

N70-17780# Tata Inst. of Fundamental Research, Bombay (India).
NUCLEAR EFFECTS DUE TO SOLAR COSMIC RAYS IN METEORITES
D. Lal, P. S. Rajan, and V. S. Venkatavardan *In* Dept. of At. Energy Proc. of the 10th Symp. of Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 70–75 refs (See N70-17766 06-29)
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Changes in isotopic composition in the near-surface regions of meteorites due to nuclear processes associated with low energy solar particles are evaluated theoretically. These effects which are confined to the top few cms. depth are shown to be distinguishable for the more permeating isotopic changes induced by galactic cosmic rays. These studies permit precise estimation of the parameters characterising the average flux of charged particles accelerated sporadically by the sun during the last tens to hundreds of million years. Combing Combining such information with measurements of prehistoric rates of accretion of certain radio nuclides, it should be possible to deduce the terrestrial accretion rate of cosmic dust during the past few millions of years. Author

N70-17781# Tata Inst. of Fundamental Research, Bombay (India).
EXPERIMENT TO DETERMINE THE CHARGE COMPOSITION OF HEAVY NUCLEI OF PRIMARY COSMIC RADIATION NEAR GEOMAGNETIC CENTER
P. C. Agarwal, M. V. K. Apparao, S. V. Bamle, G. S. Gokhale, and P. K. Kunte *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 80–83 refs (See N70-17766 06-29)
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The abundance ratio of L-nuclei to S-nuclei is used to estimate the amount of interstellar matter traversed by the cosmic rays and the abundance ratio Be/B indicates the age of the cosmic rays. A description is given of the radiation counters and spark chambers used in the balloon-borne experiment. R.B.

N70-17784# Tata Inst. of Fundamental Research, Bombay (India).
ATTEMPTS TO DETECT RELATIVISTIC HEAVY NUCLEI WITH PLASTICS
Rama, R. Sundararajan, and A. S. Tamhane *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particles Phys. and Astrophys. 6 Apr. 1968 p 93–95 refs (See N70-17766 06-29)
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The threshold dE/dX criterion of track etchability indicated that the tracks of relativistic nuclei of Fe, Co, Ni and heavier elements should be etchable in sensitive cellulose nitrate sheets. The etchability criterion, which is dependent on the rate of primary ionization rather than that of total energy loss, was revised due to the failure to etch Fe-Ni tracks in these sheets. Sheets of 250 micron thick cellulose nitrate were investigated for their utility in study of cosmic ray relativistic nuclei. The results show that the number of observed tracks is consistent with flux of superheavy nuclei recorded in earlier experiments. R.B.

N70-17786# Physical Research Lab., Ahmedabad (India).
MODULATION OF GALACTIC COSMIC RAYS (REVIEW)
R. P. Kane *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 101–108 refs (See N70-17766 06-29)
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The modulation of galactic cosmic rays due to the electromagnetic conditions of interplanetary space is described. Since neutron monitors situated at high latitudes and altitudes exhibit the greatest changes in cosmic ray intensity, the magnitude of various effects are given for a monitor located on a high mountain. Criteria are given for constructing a model of solar cosmic radiation. Although all the major cosmic ray modulation phenomena are qualitatively well understood by a given model, it is felt that more information is needed on the size, spacing, and solar activity dependence of the magnetic irregularities and gradients of cosmic ray intensity along and perpendicular to the ecliptic plane. R.B.

N70-17787# Physical Research Lab., Ahmedabad (India).
SOLAR COSMIC RAYS AS PROBES TO STUDY THE INTERPLANETARY CONDITIONS (A REVIEW)
U. R. Rao *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 109–127 refs (See N70-17766 06-29)
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Low energy cosmic rays of solar origin are particularly valuable for probing the electromagnetic state of interplanetary space, since their time of flight, direction of arrival, degree of anisotropy, and spectral modification are almost completely determined by the large and small scale features of the solar system magnetic fields through which they propagate. There are at least four prominent propagation modes of solar flare particles, namely, direct access, diffusion, bulk propagation, and convective removal by solar wind. All the flare phenomena exhibit typical changes, depending on the time of the flares. R.B.

N70-17788# Physical Research Lab., Ahmedabad (India).
ANISOTROPIES OF GALACTIC COSMIC RAYS
D. Patel, V. Sarabhai, and G. Subramanian *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 130–132 refs Supported by Dept. of At. Energy (See N70-17766 06-29)
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The anisotropies of galactic cosmic rays due to a gradient of cosmic ray density perpendicular to the plane of the ecliptic are studied through the diurnal component, the semidiurnal component, and the deficiency in intensity measure by monitors on the earth. The energy spectrum of variation that best fits the daily variation observed by a set of neutron monitors during 1964 to 1965 is derived for the diurnal and semidiurnal components separately for each day. The conditions imposed by the proposed model indicate that the components should be oriented with respect to the interplanetary magnetic field, the energy spectrum of variation of the semidiurnal component should have a positive exponent, and the diurnal anisotropy should reverse as the magnetic field or the gradient reverses. This is verified by neutron monitors for a period of six solar rotations when the interplanetary magnetic field direction in different sectors was identified. R.B.

N70-17789# Physical Research Lab., Ahmedabad (India).
ANISOTROPIES IN FORBUSH DECREASES
V. S. Iyengar, A. S. Prakasarao, and U. R. Rao *In* Dept. of At

Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 133–137 refs (See N70-17766 06-29)
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Past investigations have shown the existance of a number of differences in the onset, amplitude, and the recovery of Forbush decreases at widely separated neutron monitor stations due to anisotropies in primary cosmic radiation. As the inner regions of the plasma cloud becomes accessible to each detector on the ground, developed models predict depressed cosmic ray intensity along the lines of force of the interplanetary magnetic field. Observations by Pioneer satellites show that the onset of Forbush decreases are often accompanied by the enhancement of very low energy particles. The Forbush decreases observed at different stations are plotted as a function of the asymptotic time. Using developed two-dimensional filtration techniques, intensity profiles in space at various times are compared with Pioneer observations for the same period. The results show that besides the initial anisotropy in the form of depression on the ground, other anisotropies exist which are dependent on the interplanetary magnetic field structure. R.B.

N70-17790# Physical Research Lab., Ahmedabad (India).
DAILY VARIATION OF COSMIC RAY INTENSITY. SOLAR AND TERRESTRIAL RELATIONSHIP
R. P. Kane *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 138–145 refs (See N70-17766 06-29)
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Profile and fine structure of daily cosmic ray changes were deducted from ground based super neutron monitors of very high statistical accuracy and Pioneer 6 space probe data. Observations covering the tail end of 1965 and the beginning of 1966 established the following patterns of daily variations: (1) daily variation range was small; (2) each day showed generally one maximum and one minimum; (3) the nature of daily rise and fall differed for different days; (4) during the whole period, maximum values on successive days were on a steady level whereas minimum values curved concave upwards; and (5) both flat and sharp tops and bottoms were observed. It was assumed that the above described characteristics were connected with some sort of beam structure in interplanetary space which is still to be discovered. G.G.

N70-17791# Physical Research Lab., Ahmedabad (India).
TWENTY-SEVEN DAYS VARIATIONS IN COSMIC RAY INTENSITY AND ITS RELATION TO LONGITUDINAL DISTRIBUTION OF ACTIVE REGIONS IN SOLAR CORONA
P. N. Pathak *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 146–148 refs Supported by Dept. of At. Energy (See N70-17766 06-29)
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Presented is a study of 27-day recurrent variations in cosmic ray intensity in relation to solar and geophysical parameters for a period of 30 solar rotations. It can be seen that the distribution of large calcium plages corresponds very well with lambda 5303 longitudinal distribution. In the present study, it is found that the amplitude of diurnal variation becomes low concurrent with a decrease in mean intensity and an increase in k sub p daily cosmic ray variation and geomamnetic activity around the 9th day in solar rotation. From a separate study, (to be published) it is found that wavelength lambda 5303 intensity, on the average, has a good positive correlation with solar wind velocity. Based on this result, the fast solar wind from the active region should give rise to corotating shock front in the interplanetary space. It is concluded that day-to-day changes in the cosmic ray anisotropy may be due to nonuniformity of solar wind velocity resulting from a distribution of active regions in heliolongitudes. Author

N70-17792# Physical Research Lab., Ahmedabad (India).
VARIATIONAL COEFFICIENTS FOR VERTICAL AND INCLINED MESON TELESCOPES WITH APPLICATION TO THE DAILY VARIATION FOR TRIVANDRUM
K. N. Nair *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 149–151 refs Supported by Dept. of At. Energy (See N70-17766 06-29)
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In order to obtain reliable information regarding the daily variation of primary cosmic ray intensity, it is necessary to correct the amplitude and phase of the daily variation of secondaries recorded by ground based equipments, for meteorological effects and geomagnetic bending. The relative amplitude and geomagnetic bending at intervals of 0.2 is calculated for the following telescopes at Trivandrum: (1) vertical meson telescopes with semivertical angle of opening 10 deg, 45 deg along E.W plane and 37 deg, 45 deg along N.S plane; and (2) east and west pointing telescopes inclined 45 deg to the vertical having semi-vertical angle 10 deg, 20 deg along E.W. plane and 45 deg along N.S plane. Using the calculated variational coefficients for vertical and inclined telescopes, the parameters of the anisotropy of primary cosmic radiation can be derived from observed daily variations. Author

N70-17793# Physical Research Lab., Ahmedabad (India).
EXPERIMENTAL DETERMINATION OF TEMPERATURE EFFECT ON MUONS RECORDED AT TRIVADRUM
K. N. Nair and V. Sarabhai *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 152–154 refs Supported by Dept. of At. Energy (See N70-17766 06-29)
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The temperature effect on muon meson intensity and its contribution to the observed daily variation in vertical and inclined telescopes was analyzed by comparison with the expected variation due to primary anisotropic and barometric pressure changes. Selected were those days in which the energy spectrum of the anisotropy had a zero exponent during the period 1964 to 1965; calculations made allowances for geomagnetic bending and width of the asymptotic cones of acceptance of these telescopes. Results showed the diurnal maximum of the temperature effects occurred at late afternoon, however its amplitude depended on the location of the observation. G.G.

N70-17794# Physical Research Lab., Ahmedabad (India).
AZIMUTH EFFECT OF COSMIC RAY MESON INTENSITY AT AHMEDABAD
V. S. Iyengar *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 155–158 refs (See N70-17766 06-29)
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Evaluated was the azimuthal variation of the mesonic component at a zenith angle of 45 degrees. The meson monitor consisted of two independent triple coincidence counter telescopes of semi-angle 18 degree times 18 degree pointed to directions 180 degree apart in azimuth. Results for directions 90 degree apart in azimuth agreed with the assumption that cosmic ray meson intensity was the same for northern and southern azimuths at same cut-off energies. G.G.

N70-17795# Physical Research Lab., Ahmedabad (India).
MULTIPLICITY SPECTRUM OF A IGY NEUTRON MONITOR AT GULMARG
M. M. Bimal Khedkar, N. W. Nerurkar, and H. Razdan *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 162–164 ref (See N70-17766 06-29)
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A neutron monitor detects cosmic radiation by counting secondary neutrons produced in lead. The average multiplicity of these neutrons has been shown to be proportional to the energy of a nucleon impinging on the monitor-pile and vis-avis to the average energy of primary cosmic ray particle. An instrument is constructed and operated in conjunction with the neutron monitor

to study the multiplicity from September 1967. It is varied in steps of 100 mu seconds from 300 mu seconds upwards and the resulting variation in the counting rate is shown. At about 1100 mu seconds the rate approaches the constant value. This gate-width is used for the subsequent recording of the data. The multiplicity spectrum averaged over 14 days along with similar ones obtained at Leeds and Mt. Norikura shows fairly satisfactory agreement. No change in the multiplicity spectrum is observed at various hours of the day. Author

N70-17797# Tata Inst. of Fundamental Research, Bombay (India).
CURRENT AIR SHOWER INVESTIGATIONS
G. T. Murphy *In* Dept. of At. Energ. Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 165–180 refs (See N70-17766 06-29)
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Extensive air shower experiments are described by their results for energy spectra, composition, and arrival direction distribution of primary particles in the ranges of 10 to the power of 14 to 10 to the power of 20 eV. A comparison of experimental results with various theoretical models for high energy interactions at collision energies exceeding 10 to the power of 14 eV establishes an increase of transverse momentum of crated particles with incident particle energy and an increase in the fraction of multiple cores with primary energies. G.G.

N70-17798# Tata Inst. of Fundamental Research, Bombay (India).
STUDIES IN EXTENSIVE AIR SHOWERS AT OOTACAMUND
B. K. Chatterjee, N. V. Copalakrishnan, G. T. Murphy, B. V. Sreekantan, M. V. Srinivasa Rao et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 181–187 refs (See N70-17766 06-29)
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Low energy muons and nuclear active particles are studied in extensive air shower observations with: (1) an array of 20 scintillation detectors for sampling of electron densities; (2) fast scintillation detectors to determine arrival direction of shower; (3) total absorption spectrometers for determining the energy of N-particles; and (4) muon detectors with hodoscoped Geiger counters. Observed results show a sharp change in the slope of muon density at a shower size of 10 to the power of 6 but no anistropy for showers rich in muons within the size range 100000 to 1000000. Density of nuclear active particles depends on the steepness parameter of threshold energy and shower size; lateral distribution becomes flatter with increasing shower size and steeper as the threshold energy is increased. Correlation between fluctuations in N-particle numbers per shower at a given size, and the steepness of the shower, is linear and independent of threshold energies. G.G.

N70-17799# Tata Inst. of Fundamental Research, Bombay (India).
THE KOLAR GOLD FIELDS EXTENSIVE AIR SHOWER EXPERIMENT
G. K. Chatterjee, G. T. Murphy, S. Naranan, K. Sivaprasad, B. V. Sreekantan, et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 188–193 refs (See N70-17766 06-29)
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Measurements have been made on high energy muons in extensive air showers in the size range 10 to the 5th power - 10 to the 7th power particles. Results on the energy spectrum, lateral spread and the dependence of the total number of muons on the shower size are given. Shower size, core position and age parameter for individual showers were obtained by method of steepest descent. In the present analysis only those showers whose core fell within 50 m from the centre of the array and whose probability for detection was nearly unity were accepted. The dependence of the total number of muons of energy greater than 220 GeV and greater than 640 GeV on the shower size in the range 100000 to 1000000 to the power of 7 particles is evaluated by weighted mean slope. For 220 GeV threshold energy muons a lateral dion parameter of 20 meters is obtained. Author

N70-17800# Tata Inst. of Fundamental Research, Bombay (India).
CALCULATION OF SOME CHARACTERISTICS OF EXTENSIVE AIR SHOWERS USING DIFFERENT MODELS OF HIGH ENERGY NUCLEAR INTERACTIONS
G. T. Murphy, K. Sivaprasad, M. V. S. Rao, S. C. Tonwar, R. H. Vatcha et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 194–201 refs (See N70-17766 06-29)
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Characteristics of extensive air showers are computed by two methods based on eight plausible models of high energy interactions of nucleons and pions with air nuclei. Results on different properties of electron component, nuclear active particles and muons and the fluctuations in them are compared with the experimental data. Author

N70-17803# Regional Engineering Coll., Durgapur (India). Dept. of Physics.
MUON BUNDLES OBSERVED AT SEA LEVEL
A. K. Das and M. S. Sinha *In* Dept. of At. Energy Proc. of the 10th Symp on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 212–215 refs Supported by Dept. of At. Energy (See N70-17766 06-29)
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The simultaneous occurence of two or more parallel penetrating particles is observed in multiplate cloud chambers during interaction of sealevel muons in elements. Selected photographs from cloud chamber experiments show that: (1) incident particles are parallel within two or minus 2 degrees over the entire visible track length; and (2) particles do not undergo scattering or nuclear interaction in absorber plates. Since the parallelism of muons is maintained within 2 degrees after penetration of a lead block and chamber plates their lower energy limit is established as more than 5 GeV. It is proposed that bundles of parallel muons come from the atmosphere and fall on the detector; one particle passes through the counter telescope and thus triggers the chamber. G.G.

N70-17804# Regional Engineering Coll., Durgapur (India). Dept. of Physics.
ENERGY SPECTRUM OF MUONS FROM THEIR KNOCK-ON ELECTRONS
A. K. Das and M. S. Sinha *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 216–219 refs Supported by Dept. of At. Energy (See N70-17766 06-29)
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The experiment consisted of a cloud chamber which selected single muons in the vertical direction by means of a fourfold coincidence system counter telescope. The chamber contained target plates of carbon aluminum and copper. The photographs of the cloud chamber were scanned for events of single electrons accompanying primary muons leaving target plates. To construct the energy spectrum of muons producing knock-on electrons it was necessary to determine the projected angles of emission of the knock-on electrons with respect to the primary muon and their energies. The projected angles of emission were measured to an accuracy of 0.2 deg directly on the film and the mean was taken. Determined were energies of 289 and 271 incident muons producing knock-on electrons of energies greater than 25 MeV in carbon and aluminum and of 273 muons producing electrons of energy greater than 60 MeV in copper. Author

N70-17805# Durham Univ. (England). Dept. of Phys.
CERENKOV RADIATION OF HIGH ENERGY MUONS
M. G. Thompson and K. M. Patmak (Cotton Coll., Gauhati, India) *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968

p 220–223 refs (See N70-17766 06-29)
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A water billed directional cerenkov counter, consisting of a galvanised steel tank filled with a system of four light collectors, has been constructed. The counter was tested for its directional properties using a small telescope at 45 deg to the zenith. The results of this test show that particles traversing the counter such that the cerenkov light core strikes the detecting face directly give a pulse distribution having a width at half-height of 62.5 percent. Particles at 90 deg to this direction give very small pulses due to a small amount of light scattered back to the detecting face of the counter. Calculations show that of the light produced in the counter some 1.7% arrive at the photomultiplier cathodes and this implies a total of 18 photo-electrons leaving the cathodes of the photomultipliers per muon crossing the tank. The present results do not show any decrease of cerenkov intensity at momentum > or = to 10 Gev/c. Author

N70-17810# Physical Research Lab., Ahmedabad (India).
ISOTROPIC BACKGROUND COSMIC X-RAYS AND UPPER LIMITS FOR SOLAR X-RAY FLUX
U. R. Rao, E. V. Chitnis, and A. S. Prakasarao *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. Apr. 1968 p 274–278 refs (See N70-17766 06-29)
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Balloon measurements by NaI (Tl) counter on the isotropic X-ray component of metagalactic origin in the upper atmosphere show that counting rates decrease with altitude up to 12 mb and then increase thereafter. This increase represents the contribution from isotropic X-ray of galactic origin; its omnidirectional flux is obtained by correcting the measured flux value for atmospheric absorption and residual X-ray that can penetrate to 12 mb. Extrapolation of results gives a value of 1.5 times 0.01 photons/cubic cm sec. for the integral flux of X-rays above 50 keV. It is concluded that the flux of hard X-rays from the quiet sun varies over the solar circle. G.G.

N70-17813# Tata Inst. of Fundamental Research, Bombay (India).
RADIO EMISSION FROM SUPERNOVA REMNANTS (REVIEW)
M. R. Kundu *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 287–306 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Radioemissive properties of supernovae remnants are reviewed with special emphasis on their evolution, structure, spectra, and polarization. Supernovae remnants are classified as: (1) type one remnants from 1054, 1572a and 1604; (2) optically visible remnants corresponding to radio sources; and (3) radio sources with properties similar to visible ones but which are optically not identifiable. Their main characteristics are a non-thermal spectrum and large angular size that distinguishes them from extragalactic sources. Their contour maps also show structural details indicative of shell formation at the outer boundary. The spectral index of the remnants is on the average smaller than that of extragalactic sources but their surface brightness does not depend on distance from the supernovae source. Radio telescope observations of their structural details indicate that there is a shell formed around the rim of the expanding envelope in the direction where the interstellar material has higher density and that there may exist H2 regions. Radio emission from supernovae remnants are due to synchrotron radiation of high energy electrons evolving during interaction of the expanding envelope, and the accompanying shock wave propagating ahead of it, with the interstellar medium. G.G.

N70-17825# Banaras Hindu Univ., Varanasi (India). Engineering Coll.
SYNCHROTRON RADIATION FROM TRAPPED ELECTRONS IN THE VAN ALLEN BELT
R. N. Singh and R. P. Singh *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 365–369 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Synchrotron radiation from high energy electrons trapped in the Van Allen belts is analyzed by evaluating the effects of electron energy and geomagnetic field intensity on radiation frequency, maximum power, and beam width of maximum power as relativistic electrons radiate along the instantaneous velocity vector. The variation of radiated power per electron during its travel along the line of force is found to increase as particles move downwards subject to pitch angle distribution. By dividing the whole relativistic energy range into energy intervals and by multiplying the average power per electron in one energy range by the fraction of electrons, the corresponding powers are determined. It is found that total radiated power becomes maximum at non-equatorial latitudes along the lines of force. G.G.

N70-18169# Utah Univ., Salt Lake City.
ZENITH-ANGLE DISTRIBUTION OF ULTRA-HIGH-ENERGY MUONS
J. W. Keuffel, J. L. Osborne, G. L. Bolingbroke, G. W. Mason, M. O. Larson et al [1969] 17 p Held at the Eleventh Intern. Conf. on Cosmic Rays, Budapest, 25 Aug.–4 Sep. 1968 Sponsored by NSF
Avail: CFSTI

The zenith-angle distribution of ultrahigh energy muons is of great importance because, in the conventional picture of high-energy interactions, the dominant source of muons is the decay of pions and kaons; and the competition between decay and capture of these parent particles produces an enhancement of the muon intensity at large zenith angles which is a definite, testable consequence of the theory. The statistical sample is large enough to permit a direct study of the intensity vs. zenith angle at fixed depths, eliminating in this way any dependence on the average density of the rock and vertical intensities. Author

N70-18208# International Astronautical Federation, Paris (France). Scientific Group for Space Research.
DATA OF SOLAR-TERRESTRIAL INTEREST
D. J. Ilias, and D. P. Elias, eds. Athens Mar. 1969 22 p
Avail: CFSTI

Data derived from routine observations at several Greek stations are tabulated and plotted. The following events during March 1969 are covered: (1) diurnal variations in signal levels, presented in the form of median graphs; (2) observations of solar flare phenomena; (3) selected recordings obtained during the month; (4) optical observations made by satellite; and (5) sunspot activity as determined by visual observations. A.C.R.

N70-18227# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
CALCULATIONS OF EARTH SELF-RADIATION ON A SPACE VEHICLE [CALCUL DU RAYONNEMENT PROPRE DE LA TERRE RECU PAR UN ENGIN SPATIAL]
V. M. Zaletaev [1969] 15 p refs In FRENCH and RUSSIAN (LRBA-69-1209) Avail: CFSTI

A diffuse radiating sphere with a uniform surface density discharging self radiation was used to mathematically model earth self- or long wave radiation levels on a space vehicle. An expression is solved describing the radiant thermal flux on the vehicle surface. Results are used to determine the relationship between the flux on a surface with central symmetry and the flux on a surface detached from the target by an arbitrary density. When rotating the specified surface around an arbitrary horizontal axis, the average flux value for one revolution on the half-surface is equal to the flux value for one revolution of the entire surface. Transl. by E.C.

N70-18267# Lockheed Missiles and Space Co., Palo Alto, Calif.
ION EXCITATION, IONIZATION AND RECOMBINATION RATES IN THE PLASMA OF THE SOLAR CORONA

I. L. Beigman et al [1969] 7 p refs Transl. into ENGLISH from Astron. Zh. (USSR), v. 46, no. 5, 1969 p 985–992
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Excitation, ionization, photorecombination, and dielectronic recombination processes of highly charged ions in collisions with electrons are considered. Under the assumption of a Maxwell electron distribution, simple two-parameter approximate formulas are proposed for the rates of these processes. Values of the parameters are presented for the excitation of H- and He-like ions and for the ionization and recombination of ions belonging to the isoelectronic sequences from H to Ne. Ionization curves for ions responsible for the X-radiation of the solar corona are computed by utilizing these cross sections. Author

N70-18292# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
A METHOD OF CALCULATING THE ILLUMINATION OF AN APPARATUS IN SPACE BY EXPLORATION, REFLECTED SOLAR RADIATION [METHODE DE CALCUL DE L'ENSOLEILLEMENT D'UN ENGIN SPATIAL DU AU RAYONNEMENT SOLAIRE REFLECHI]
G. P. Kobranov and A. I. Belov [1969] 12 p Transl. into FRENCH from Krasovskii Kosmich. Issled., v. 6, no. 5, 1968 p 730–734 In FRENCH and RUSSIAN
(LRBA-69-1210) Avail: CFSTI

A machine method is considered for calculating the illumination of an apparatus in space by reflected solar radiation, which excludes the necessity of integrating the visible portion of the illuminated surface of the earth when ascertaining thermal flows. The thermal flow is given in the form of a polynomial function obtained by first integrating the reflected radiation from the visible portion of the illuminated surface of the earth for the cases when the surface of the apparatus, the earth, and the sun are in mutual apposition, and then by subsequent approximation of the results obtained. Transl. by R.B.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-16935*# Analytical Mechanics Associates, Westbury, N.Y.
OPTIMAL HYBRID PROPULSION SYSTEMS THRUST TRAJECTORIES IN A PATCHED-CONIC N-BODY FORCE FIELD
Samuel Pines Feb. 1969 28 p refs
(Contract NASw-1684)
(NASA-CP-107792; Rept-69-2) Avail: CFSTI CSCL 22C

This report derives the differential equations for optimal thrust trajectories and the corresponding variational equations for power-limited (and/or thrust-limited) hybrid propulsion systems operating in a patched-conic N-body dynamical environment. The paper derives the optimal switch times for engine cut-off, planetary sphere of influence encounter, and hybrid propulsion systems' thrust exchange. The method described herein gives an excellent approximation to the problems of obtaining realistic launch windows and overall fuel cost for maximum payload, and solves the complicated heliocentric, planetocentric interface problem in a direct and rational fashion. Author

N70-16952# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 218 10 Dec. 1969 p 1–5 refs (See N70-16951 06-13)
Avail: CFSTI

News briefs on solar research and other astronomical topics are presented. Rates of excitation, ionization, and recombination of ions the plasma of the solar corona are discussed. The inhomogeneous structure of circumsolar plasma was studied and the instabilities possible were analyzed. The rapidly transpiring processes on the sun were investigated using cinematography. A new method is described to determine the potential and gravity distribution on the moon. Preliminary work in preparation for studying signals from outer space, and construction at the Zelenchukskaya Astrophysical Observatory are mentioned. N.E.N.

N70-16996# California Inst. of Tech., Pasadena.
THE 21 CM ABSORPTION PROFILES OF DR 21 AND THE SOURCE NEAR NGC 6857
A. R. Thompson, R. S. Colvin, and M. P. Hughes 1969 26 p refs
(Contract N00014-67-A-0094-0008)
(AD-696118) Avail: CFSTI CSCL 3/2

The 21 cm absorption profiles of two dense thermal sources, DR 21 and the source near NGC 6857 have been obtained using the interferometer at the Owens Valley Radio Observatory. DR 21 shows absorption over a range of radial velocities from +18 to -20 km/sec (with respect to the local standard of rest), although on the basis of the observed radial velocity and the usual model for galactic rotation one would not expect to find galactic clouds with negative radial velocities between the sun and the source. The neighboring source DR 23 does not appear to show appreciable negative-velocity absorption. Three explanations for the observations of DR 21 are discussed. The radio source previously identified with NGC 6857 has been reported by Rubin and Turner (1969) to be centered 1 ft north of the nebula, at a position that coincides with the small planetary nebula K 3-50. The ionized hydrogen absorption for the source extends from +20 to -33 km/sec and a distance between 7.5 and 9.6 kpc is deduced. Author (TAB)

N70-17027*# National Aeronautics and Space Administration, Washington, D.C.
MANNED SPACE-FLIGHT CAPABILITIES, APPENDIX A
George E. Mueller and John Hammersmith *In its* Proc. of the Winter Study on Uses of Manned Space-Flight 1975–1985 1969 p 1–13 (See N70-17026 06-34)
Avail: CFSTI CSCL 22A

Systems descriptions of NASA manned space flight capabilities from the early 1970's to 1980 and beyond are presented. The Apollo Applications Program (AAP) which was conceived to make optimum use of the manned space flight capability developed during Gemini and Apollo, and takes advantage of the space facilities, vehicles and organizations of the Apollo program is discussed. It includes the Saturn 1 workshop mission (AAP-1/AAP-2) which use the empty hydrogen tank of the S-4B stage as the nucleus of an embryonic space station, and is designed to provide space and facilities for a broad spectrum of experiments that will provide a foundation of basic information essential to the design and development of follow-on space station systems. A formal space station program, a low cost transportation system for the logistical support of the space station, and lunar exploration are also described. F.O.S.

N70-17028*# National Aeronautics and Space Administration, Washington, D.C.
LOW-COST SPACE TRANSPORTATION, APPENDIX B
Francis Clauser *In its* Proc. of the Winter Study on Uses of Manned Space-Flight, 1975–1985 1969 p 15–28 (See N70-17026 06-34)
Avail: CFSTI CSCL 22A

Space transportation costs are discussed in terms of the average citizen affording a space ticket, and space travel becoming commonplace. The development costs of a supersonic transport are compared to the development costs of the Saturn 5, and the conclusion is reached that if the supersonic transport lasted for only one flight the costs of an air travel ticket would approximate that

of space travel. It is concluded that increased utilization must be achieved by: (1) reuse of space vehicles; (2) reduce the cost of each reuse, so that the cost is low compared to new vehicles; and (3) increase the utility of productivity of the space vehicle. F.O.S.

N70-17029*# National Aeronautics and Space Administration, Washington, D.C.
THE LUNAR PROGRAM, APPENDIX C
Harry Hess and Noel Hinners *In its* Proc. of the Winter Study on Uses of Manned Space-Flight, 1975–1985 1969 p 29–50 refs (See N70-17026 06-34)
Avail: CFSTI CSCL 22A

The likely lunar activities for 1975 to 1985 using as a basis the lunar exploration, and progress of the 1969 to 1974 period are predicted. Included are: continued multisite exploration, establishment of a lunar base, continued scientific exploration of the moon, the moon as a base for nonlunar science, use of the moon as a refueling and launch platform, return of lunar materials to earth, construction and processing on the moon for space systems or return to earth, and lunar-base technological support operations. F.O.S.

N70-17030*# National Aeronautics and Space Administration, Washington, D.C.
ASTRONOMY, APPENDIX D
Leo Goldberg and David Wood *In its* Proc. of the Winter Study on Uses of Manned Space-Flight, 1975–1985 1969 p 51–72 refs (See N70-17026 06-34)
Avail: CFSTI CSCL 03A

The potentially useful role of man in space astronomy is described on the basis of certain fundamental assumptions that are believed plausible in the post-1975 period. These assumptions are: (1) Logistics and rendezvous are cheap and safe. (2) Man is as useful in space as on earth, providing that the man–machine interface has been properly designed. (3) Continuously manned stations are available in space, in low orbit, in synchronous orbit, and/or on the lunar surface. It is concluded that the availability of man in space is indispensable to the continued, efficient operation of complex astronomical instruments in space, and it is recommended that any lunar exploration program include an astronomical site survey for deployment of a large radio telescope on the lunar surface. F.O.S.

N70-17031*# National Aeronautics and Space Administration, Washington, D.C.
SPACE PHYSICS, APPENDIX E
Louis Alvarez, Jared Anderson and Leon Kaufman *In its* Proc. of the Winter Study on Uses of Manned Space-Flight, 1975–1985 1969 p 73–83 refs (See N70-17026 06-34)
Avail: CFSTI CSCL 03B

A study of the physics of the space environment is presented based on the assumption that a substantial manned space capability will be available in the post-1975 period. The most important foreseeable physics research areas that will benefit are considered to be: (1) high energy, and cosmic ray physics; (2) behavior of solids, liquids, and gases in zero-gravity; (3) relativity, cosmology, and gravitation physics; (4) micrometeoroid measurements, gegenschein, zodiacal light, and matter at the libration points; and (5) magnetospheric physics and study of trapped radiation belts and aurora, wave propagation in a dilute plasma, and interaction of the solar wind with the moon. F.O.S.

N70-17037# Army Foreign Science and Technology Center, Washington, D.C.
ANISOTROPIC SCATTERING OF LIGHT IN AN ATMOSPHERE OF GREAT OPTICAL THICKNESS
V. V. Sobolev 20 Oct. 1969 21 p refs Transl. into ENGLISH from J. Astrofizika (USSR), v. 4, no. 3, Aug. 1968 p 325–336
(AD-697074; FSTC-HT-23-675-69) Avail: CFSTI CSCL 3/2

Diffusion of radiation in an atmosphere of great optical thickness at an arbitrary indicatrix of scattering is considered. The case of an atmosphere of large optical thickness and small true absorption has been considered and expressed in terms of similar quantities in the case of semi-infinite medium with pure scattering. TAB

N70-17046*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
ENERGETIC GAMMA RAY EMISSION FORM THE GENERAL DIRECTION OF THE CYGNUS CONSTELLATION
J. V. Valdez, P. S. Freier, and C. J. Waddington Jul. 1969 17 p refs Presented at 11th Intern. Conf. on Cosmic Rays, Budapest, 1969
(Grant NGR-24-005-050; Contract Nonr-710(60))
(NASA-CR-107805; SD-694460; CONF-124; CR-140) Avail: CFSTI CSCL 03B

A combination nuclear emulsion and spark chamber gamma ray telescope has been flown on a high altitude balloon to study a region in the constellation Cygnus for evidence of possible point source or line source emission of E > 100 MeV gamma rays. The region surveyed in this observation covers approximately 280 degrees to 315 degrees R. A. and 25 degrees N to 45 degrees N declination. In this region lie two potential point sources, Cyg A and Cyg XR-1, together with a section of the galactic plane covering galactic longitudes of 60 to 90 degrees. The response of the detector has been calculated using a Monte-Carlo simulation. This enables us to derive an energy spectrum and flux value for the general background of gamma rays, which are presumably atmospheric in origin. Author (TAB)

N70-17164# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
COMPACT RADIO SOURCE IN THE NUCLEUS OF M87
M. H. Cohen, A. T. Moffet, D. Shaffer, B. G. Clark, and K. I. Kellermann 1969 9 p refs
(Contract N00014-67-A-0094-0008)
(AD-696119; Rept-10-1969) Avail: CFSTI CSCL 3/2

The compact radio source in M 87 has been observed with a long baseline interferometer composed of the 210-foot telescope at Goldstone, California, U.S.A., and the 85-foot telescope at Tidbinbilla, near Canberra, A.C.T., Australia. The observations suggest that the radio source is remarkably concentrated to the galactic nucleus and has a linear diameter of about 2.5 light months. TAB

N70-17168# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
ELDO-PAS: OPTIMISATION OF THE TIME OF INJECTION FROM TRANSFER ORBIT INTO NEAR-GEOSTATIONARY ORBIT OF A SPINNING SATELLITE
M. Lamers and G. M. van Eek 25 Aug. 1969 133 p refs Sponsored by ELDO
(NLR-TR-69077-U) Avail: CFSTI

A computer program is described which calculates the optimal firing time of the apogee motor of the ELDO-PAS satellite. It is optimal in the sense that the amount of correction velocity required to obtain a geostationary orbit out of the near-geostationary drift orbit resulting after apogee motor firing, will be minimum. The duration of visibility from the ground station is also calculated. A summary of the underlying theory is given and results are shown of a sensitivity analysis of variation influence of several input parameters. Author (ESRO)

N70-17203# Defense Documentation Center, Alexandria, Va.
THE MOON, VOLUME 1 A DDC Bibliography, Jan. 1953–Dec. 1968
Sep. 1969 243 p refs
(AD-694500; DDC-TAS-69-60-1-Vol-1) Avail: CFSTI CSCL 3/2

The bibliography is a collection of unclassified reports (with unlimited distribution) on lunar properties. Author (TAB)

N70-17252# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
ELDO-PAS ORBIT DETERMINATION PROGRAM. PART 1: THEORY
J. L. de Jong, H. A. van Ingen Schenau, and O. B. M. Pietersen 11 Jul. 1969 75 p refs Sponsored by ELDO
(NLR-TR-69055-U-Pt-1) Avail: CFSTI

The theory which forms the basis of the ELDO-PAS orbit determination program developed by NLR is discussed. The program computes the position and velocity (state vector) of the ELDO-PAS satellite at a predetermined reference time from an input of three pairs of observation angles at three different times. Given this reference state vector, it is possible to determine the position and velocity of the ELDO-PAS satellite at any other time in the past or in the future. The orbit determination program, which is completely deterministic, is a realization of the differential correction concept. For an estimated reference state vector, which is equivalent to an estimated trajectory, the observation angles at predetermined observation times are computed and compared with the actual observations. Thereafter the reference state vector is changed in order to make the difference as small as desired. Author (ESRO)

N70-17253# Leiden Univ. Observatory (Netherlands). Galaxies and Cosmology Div.
ASPECTS OF RADIO GALAXY EVOLUTION
H. van der Laan and G. C. Perola [1969] 36 p refs Sponsored partly by ESRO
Avail: CFSTI

Schmidt's analysis of the relation between radio galaxies and superluminous elliptical systems is briefly reviewed. Some pertinent features of radio spectral distributions based largely on the extensive and homogeneous data are discussed. Absolute upper limits for the duration of the radio emission phase of a relativistic electron flux are derived, and modes of source evolution on the basis of the preceding analysis are discussed. A scheme of multiple noncumulative bursts, which conforms with observational data, is also presented. ESRO

N70-17306# Sao Paulo Univ. (Brazil). Center of Studies in Celestial Mechanics.
RESEARCH IN CELESTIAL MECHANICS AND DIFFERENTIAL EQUATIONS Annual Technical Report
Giorgio E. O. Giacaglia, Waldyr M. Oliva, Nelson Onuchic May 1969 163 p refs
(Contract N00014-67-C-0347)
(AD-696981; CEMC-IPM-USP-68/69-02; AR-2) Avail: CFSTI CSCL 3/3

Contents: Celestial Mechanics: Trigonometric Interpolation Parametric Representation of Resonance in the Restricted Problem, Resonances in the Restricted Problem, Double Resonance in the Motion of a Satellite, An Approach to the Elliptic Restricted Problem of Three Bodies, Motion in the Neighborhood of L sub 1 in the Sun Perturbed Earth-Moon System. Differential Equations: Lagrangian Systems on Manifolds, - Reduced Liapunov Stability of Steady Motions, The La Salle Invariance Principle for Multidimensional Dynamical Systems, Stability Properties of a Second Order Differential Equation, Asymptotic Equivalence Between two Systems of Ordinary Differential Equations, Asymptotic Behavior and Existence of Periodic Solutions of a Class of Non-Linear Ordinary Differential Equations of the Second Order, Alekseevs Integral Formula and Applications in Stability Problems. TAB

N70-17375# Royal Aircraft Establishment, Farnborough (England).
VARIATIONS IN EXOSPHERIC DENSITY DURING 1967 AND 1968, AS REVEALED BY ECHO 2
G. E. Cook Jun. 1969 26 p refs
(RAE-TR-69127) Copyright. Avail: CFSTI

Values of atmospheric density at heights near 1000 km have been obtained from the orbit of Echo 2 during 1967 and 1968. The results clearly show the existence in the exosphere of 27-day variations associated with the rotation of the sun and also correlation with geomagnetic disturbances. The semi-annual variation in the exosphere is again apparent, and has now been traced from before solar minimum in 1964 up to and probably past the current solar maximum; the magnitude of the semi-annual density variation shows no definite dependence on the level of solar activity. The irregular year-to-year variations in the effect are similar to those at lower heights, being large at all heights at the same time. The variation in the exosphere exceeds the magnitude expected on the basis of variations at lower heights at dates before July 1966 and after April 1968, but is of the expected magnitude between these dates. Author (ESRO)

N70-17376*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE PLANET JUPITER
V. A. Bronshten ed., et al 1969 91 p refs Transl. into ENGLISH of the book 'Issledovaniya Planety Yupiter' Moscow, Izd. Nauka, 1967 p 1–89 Sponsored by NASA and NSF
NASA-TT-F-563; TT-69-55026) Copyright. Avail: CFSTI CSCL 03A

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7. THE FEATURES OF JUPITER V. A. Zinovev p 59–67 (See N70-17383 06-30)
8. JUPITER IN 1964 V. A. Zinovev p 68–71 (See N70-17384 06-30)
9. OBSERVATIONS OF JUPITER DURING THE OPPOSITION OF 1964 N. K. Andrianov p 72–78 refs (See N70-17385 06-30)
10. JUPITER IN 1963 – 1964 I. N. Potapov p 79–86 refs (See N70-17386 06-30)
11. THE THREE SYSTEMS CHARACTERIZING JUPITER'S ROTATION I. N. Potapov p 87–89 refs (See N70-17387 06-30)

N70-17377*# Israel Program for Scientific Translations, Ltd., Jerusalem.
MOLECULAR ABSORPTION OF LIGHT IN JUPITER'S ATMOSPHERE AND THE SURFACE STRUCTURE OF THE PLANETARY CLOUD LAYER
V. G. Teifel' *In its* The Planet Jupiter 1969 p 1–14 refs (See N70-17376 06-30)
Copyright. Avail: CFSTI CSCL 03A

Jupiters atmosphere is described by the following model: (1) the outer atmosphere, which is the gas layer above the surface of the cloud cover around the planet; (2) the condensation zone, which is a cloud layer of a gas-aerosol mixture that contains solid particles in its upper part and liquid drops in the lower part; (3) the lower atmosphere, which is a high pressure region of compressed gas; and (4) the transition zone, a relatively thin layer of matter in a semiliquid state overlying the solid mantle of Jupiter. The strongest absorption band in the visible spectrum of the planet is the 6190 A band of methane; its equivalent width is almost independent of location on the disk and varies by as little as minus

or plus 1 A. A simplified two-layer model of Jupter's absorbing atmosphere, consisting of a clear gaseous atmosphere and a cloud layer containing aerosol particles, is used to analyze the infrared absorption bands of methane and ammonia; it is shown that the strong absorption bands cannot have a constant intensity over the disk. Photometric and spectroscopic observations of the dark belts and polar regions on Jupiter indicate that the belts apparently consist of the same cloud formations as the zones but contain darker particles which probably differ from lighter ones by color and size. The same is assumed for the polar regions. G.G.

N70-17378*# Israel Program for Scientific Translations, Ltd., Jerusalem.

TENTATIVE PHOTOMETRY OF JUPITER'S ATMOSPHERIC ACTIVITY

A. N. Aksenov *In its* The Planet Jupiter 1969 p 15–19 refs (See N70-17376 06-30)

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Described is a short term periodicity in the activity fluctuations of Jupiter's atmosphere with the appearance of dark belts and light zones parallel to the planet's equator. Analyses of 50 series of Jupiter photos establish the activity coefficients within the zone between -45 and +45 degrees latitude; maximum activity is noted in September, beginning when the concentration of dark matter raised by atmospheric pressure processes from the deeper layers to the visible surface of the planet was the lightest. In the second half of September the activity started to decline and the contrast between belts and zones diminished until a minimum activity is reached in October. Then another rise in activity starts again accompanied with the rise of additional dark matter to the surface. Thus, a certain periodicity with a cycle of 3 months is displayed. G.G.

N70-17379*# Israel Program for Scientific Translations, Ltd., Jerusalem.

LONG-TERM VARIATIONS IN THE WIDTH OF JUPITER'S BELTS

V. A. Bronshten et al *In its* The Planet Jupiter 1969 p 20–25 refs (See N70-17376 06-30)

Copyright. Avail: CFSTI

Measurement results on variations in the widths of the northern and southern tropical Jupiter belts are analyzed and the following conclusions are presented: (1) the two tropical belts vary appreciably in widths over two to four with the amplitude sometimes reaching 16 degrees; (2) southern tropical belt width fluctuates during this period by 5 to 16 degrees and the northern tropical belt width varies within 4 to 16 degrees; (3) during the periods of 1915 to 1924 and 1929 to 1939, there is a marked alternation of maxima and minima in the widths of the two belts which occur in cycles of about 3.5 years; (4) during 1948 to 1951 the width of the belts show variations with a mean period of 4.1 years; (5) over this same period of the northern tropical belt width in the whole increases and the southern tropical belt width decreases until in 1962 the two tropical belts merged near the equator; and (6) the combined width of Jupiter's tropical belts varies within 15 to 30 degrees and does not display any periodicity. G.G.

N70-17380*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE BELTS AND OTHER FEATURES ON JUPITER IN 1960

V. A. Egorov *In its* The Planet Jupiter 1969 p 26–29 refs (See N70-17376 06-30)

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Plots of the variations in the width of the polar caps, the two tropical belts, and the south temperate belt of Jupiter during 1960 show no appreciable variatios. The only exception is noted at the north polar gap whose width changed about 6 degrees. Author

N70-17381*# Israel Program for Scientific Translations, Ltd., Jerusalem.

VISUAL OBSERVATIONS OF JUPITER DURING THE FLARE OF 1961 – 1964

S. K. Vsekhsvyatskii *In its* The Planet Jupiter 1969 p 30–55 refs (See N70-17376 06-30)

Copyright. Avail: CFSTI CSCL 03A

Analysis on a series of visual observations of the Jupiter flare during 1961 to 1964 shows that the initial stage of activity is cataclysmic and leads to the formation of bright white spots, and also of pairs of clusters of spots. This is followed by the appearance of dark nodules that eject dark filament streaks which move toward the poles in the direction opposite to the sense of planetary rotation. The streaks develop into bands and this marks the maximum activity. Afterwards, the dark belts grow slowly fainter. Photometric measurements during this stage are consistent with the hypothesis of descending motion of dark matter. Taking into account the albedo of the dark matter in the belts and the activity pattern on the planet indicates that the belts are made up of ash particles injected into the upper layers of Jupiter's atmosphere by recurrent volcanic eruptions. G.G.

N70-17382*# Israel Program for Scientific Translation, Ltd., Jerusalem.

CHANGES IN JUPITER'S SYSTEM

S. K. Vsekhsvyatskii *In its* The Planet Jupiter 1969 p 56–58 refs (See N70-17376 06-30)

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Analyses of observational data suggests that the equatorial Jupiter belt was produced by large masses of ash particles and gas which rose above the cloud layer and formed a wide ring around the planet. Radar occulatation and brightness determinations of the satellites at the western limb supported the screening effect of ash clouds moving around Jupiter and a change in the albedo of the satellites produced by precipitation of volcanic ash on their surface. It was concluded that an outbursts of volcanic activity was responsible for the formation of the dark equatorial belt. G.G.

N70-17383*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE FEATURES OF JUPITER

V. A. Zinovev *In its* The Planet Jupiter 1969 p 59–67 (See N70-17376 06-30)

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Refractory observations of Jupiter were carried out during five months from October 1963 to February 1964; during this time Jupiter's equatorial belts showed a brownish color and merged into a single girdle about 30 degree wide. The red spot was bright red, the north polar cap brown, and the south polar cap faint gray. The zone of equatorial belts showed strong dark currents and various cloud groups. Appearance of the planet changed frequently and usually after a period of turbidity the surface would clear up and show the contrasting features clearly. Of interest was the strong disturbance of the south temperate belt with many dark spots and gaps dispersed over it subsequent to the appearance of an elongated gray spot fragmented by small clouds that assumed a twisted shape. In the protusions of the belt near the white spot and the red spot there were formations of lower intensity, resembling clouds. A comparison of drawings taken at large intervals of time shows that the white clouds moved faster than the red spot. G.G.

N70-17384*# Israel Program for Scientific Translations, Ltd., Jerusalem.

JUPITER IN 1964

V. A. Zinovev *In its* The Planet Jupiter 1969 p 68–71 (See N70-17376 06-30)

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The observations of Jupiter were begun at the end of May 1964 using the 30-cm refractor. There were some changes in the appearance of the planet compared with 1963: the brightness of

the south tropical zone strongly increased, the equatorial zone became more sharply defined, the narrow belts in the tropical zones increased in intensity, and a red coloration showed only in the red spot and the south equatorial belt. The south tropical belt partly blended with the wide girdle of equatorial belts, and over the north equatorial belt persistent clouds and strong dark currents developed. Radical changes took place in the north equatorial belt below the red spot, resulting in the appearance of a stable cloud formation. There was an unusual rise in the intensity of the two belts in the north polar cap, while the south temperate belt showed areas of extremely low intensity. Author

N70-17385*# Israel Program for Scientific Translations, Ltd., Jerusalem.

OBSERVATIONS OF JUPITER DURING THE OPPOSITION OF 1964

N. K. Andrianov *In its* The Planet Jupiter 1969 p 72-78 refs (See N70-17376 06-30)

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Visual observations of Jupiter by 165-mm reflector and equatorial mounting resulted in a total of 114 drawings for the period from 1 September 1964 to 31 January 1965. The observational program also included systematic evaluations of the intensity of the belts and polar caps. Analyzed were the distribution of the features on the planetary disk, the latitudinal motion of the belts, and the variation of their intensity during the relevant period. The proper motion of the red spot over the planetary disk was also investigated. 34 drawings of Jupiter showing the Red Spot were processed and the apparent displacement of the red spot over the planetary surface during the observation period was plotted graphically. It was found that: (1) red spot latitude decreased by about 8 degrees during the observation period; (2) red spot moved towards the southern polar cap by almost 5 degree latitude; and (3) the rate of motion along the trajectory increased somewhat at the end of November and the beginning of December 1964, and then fell off rapidly. G.G.

N70-17386*# Israel Program for Scientific Translations, Ltd., Jerusalem.

JUPITER IN 1963-1964

I. N. Potapov *In its* The Planet Jupiter 1969 p 79-86 refs (See N70-17376 06-30)

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The series of observations of Jupiter during 1963 to 1964 covered north and south polar caps, north and south temperate and tropical belts, and the red spot. The mean latitudes of the edges of the belts and caps were obtained and an attempt was made to correlate the intensity of the belts with their width. In 1962 the northern and southern tropical belts merged into an equatorial girdle concurrent with a rise in the activity of the red spot. During fall 1962 the girdle split up and the tropical belts drifted slowly towards the poles. Plotted variations in the width of the equatorial zone for the period 1962 to 1964 indicate meridional currents on a planetary scale. G.G.

N70-17387*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE THREE SYSTEMS CHARACTERIZING JUPITER'S ROTATION

I. N. Potapov *In its* The Planet Jupiter 1969 p 87-89 refs (See N70-17376 06-30)

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The rotation of Jupiter about is axis is described by the following three longitudinal systems: (1) system I is derived from observations of the planet's equatorial zone and has a rotational period of 9 hrs 50 minutes 30 sec. 003; (2) system II has a period of 9 hrs 54 minutes 40 sec.632; and (3) system III is based on radio-astronomical data and has a period of 9 hrs. 55 minutes 29 sec.37. The vertical distributions of the various formations in Jupiter's atmosphere are approximated according to the particular rotation system to which they belong and results identify the atmospheric layers responsible for the light zones, the dark belts, and the radio source used to define system III. System II is related to the outermost layers of Jupiter's atmosphere, while the motion of the deepest layers are represented by system I. It is concluded that the angular velocity in Jupiter's atmosphere decreased with increasing altitude above the planetary surface. G.G.

N70-17396*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DECAMETER-WAVE RADIO OBSERVATIONS OF JUPITER: APPARITIONS OF 1965 TO 1969

J. K. Alexander Jan. 1970 159 p refs

(NASA-TM-X-63806; X-615-70-2) Avail: CFSTI CSCL 03A

Systematic observations of the decameter wave radio emissions from Jupiter obtained by a network of monitoring stations were analyzed for the period November 1965 to June 1969. A total of 4041 hours of observations at 16.7 MHz and 5514 hours of observations at 22.2 MHz from five different sites were catalogued, and the Universal Times for each observing period and activity period are listed by frequency and station. A summary of the occurrence statistics as a function of System III Central Meridian Longitude and phase of the satellite Io is also shown. Author

N70-17416*# International Business Machines Corp., Houston, Tex. Federal Systems Div.

INTRODUCTION TO TRAJECTORY ESTIMATION FOR RTCC PROGRAMMERS

Robert G. Rich 5 Sep. 1969 139 p refs

(Contract NAS9-996)

(NASA-CR-102079; H69-0009-R) Avail: CFSTI CSCL 22C

A statistical method of navigation for resolving measurements into a best estimate of initial conditions is studied. Mathematical formulations of processing radar and optical measurements to estimate the position and velocity of a spacecraft are presented and equations of motion for spacecraft in either free or powered flight are developed. The estimated trajectory parameters become the initial conditions for integrating the equation of motion to predict new values of the parameters for the next computation. The measurements required are range, range-rate, and various angles, which can be determined from a knowledge of the geometry and dynamics. These data are transmitted to the memory of a digital computer where they are available to the processor. The program solves a system of equations expressing the best estimates of the parameters as functions of the measurements. F.O.S.

N70-17456*# Masschusetts Inst. of Tech., Cambridge. Center for Space Research.

THE CRAB NEBULA ANCIENT HISTORY AND RECENT DISCOVERIES

B. B. Rossi Oct. 1969 39 p refs

(Grant NGR-22-009-015)

(NASA-CR-107845; CSR-P-69-27) Avail: CFSTI CSCL 03A

A model is developed which pictures the Crab Nebula as a thin plasma cloud containing a weak magnetic field, with a fast rotating strongly magnetized neutron star at its center. The magnetization of the star does not have axial symmetry, so that the rotation gives rise to time varying electromagnetic fields which are capable of accelerating electrons. These electrons remains within the corotating magnetosphere of the neutron star, where they give rise to fan shaped corotating beams of electromagnetic radiation. Subsequently, they diffuse into the surrounding cloud, where they acquire further energy by a Fermi-type stochastic process. Synchrotron emission by these electrons in the weak magnetic field of the cloud gives rise to the steady flux of radiation. Author

N70-17481# National Physical Lab., Teddington (England). Quantum Metrology Div.

AN INVESTIGATION OF SOME ASPECTS OF THE ULTRA-VIOLET SPECTRUM OF HYDROXYL

Margaret Weston Aug. 1969 30 p refs

(NPL-QU-6) Copyright. Avail: CFSTI

An attempt was made to study the vacuum ultra-violet spectrum of hydroxyl. Several sources were tried but all proved unsuccessful. A system of bands around 3000 A was studied for various sources and the intensities of the lines in the R sub 2 branch of the O-O band looked at. It was seen that for hydroxyl formed by chemical reactions (as used in the various sources) a rotational temperature could not meaninfully be assigned to the gas. Author (ESRO)

N70-17471*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME-OPTIMAL CONTROL OF GRAVITY GRADIENT SATELLITES WITH DISTURBANCES
Franz Zach Nov. 1969 53 p refs Submitted for publication
(NASA-TM-X-63799; X-734-69-501) Avail: CFSTI CSCL 22A

The optimal control of spacecraft with gravity gradient coarse stabilization and active libration damping for precision pointing is presented. Laser communications uses this since angular position within .001 deg must be achieved and maintained in the presence of disturbances. A suboptimal (i.e. nearly optimal) control law for the general gravity gradient satellite (GGS) is obtained by a two step approximation: first the general GGS is approximated by a dumbbell satellite (DS) and secondly a small angle approximation is derived. The optimal control law for this case is calculated and applied to two representative examples of a 24 hour synchronous GGS. The practical results are discussed. The optimal control law derived for the DS works for the general GGS as a suboptimal control law. The maximum principle is also extended to cover operating conditions with disturbances. Disturbances change the optimal control law significantly, a result that is very important for practical applications of the maximum principle. Author

N70-17611*# Ball Bros. Research Corp., Boulder, Colo.
LIGHT-WEIGHT WOLF TRAP STUDY Final Report
F. G. Brown, D. E. Buckendahl, V. H. Henthorn, J. D. Pace, and A. J. Ray 5 Nov. 1969 70 p refs Prepared for Rochester Univ.
(Grant NGR-33-019-002)
(NASA-CR-107876; F69-05) Avail: CFSTI CSCL 06M

Three different light-scatter cell configurations were constructed and tested. The light scatter cell is used to measure the particles present in a liquid solution, thus providing another means for detecting the presence and growth of live organisms. A breadboard model of the third configuration tested showed good detection sensitivity and a subsequent test model built and tested briefly before the program ended gave good results. The necessary electronics for the light scatter cell were also designed and tested. The final configuration was a differential system using a reference compensated for stray light and temperature. The testing performed on the differential system indicated that it would be a significant improvement over the system used in the earlier Wolf Trap model. A preliminary flight configuration system design was evolved. This design is a carousel type capable of testing nine samples and would weigh approximately 10 pounds, including electronics. Author

N70-17532*# Illinois Univ., Urbana.
SPACE AND ATMOSPHERIC SCIENCES
A. Cohen, D. H. Cooper, G. R. Karr, H. W. Knoebel, J. L. Myers et al. *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 123-147 refs (See N70-17526 06-34)
(Grant NsG-443)
Avail: CFSTI CSCL 22C

The status of the feasibility study for the orbiting gyro relativity satellite is given. The program and objectives of the study of another orbiting gyro experiment designed to measure gas density and gas-surface interaction parameters are given. The results of a preliminary study of a composite shaped satellite are given which illustrate the feasibility of the proposed atmospheric experiment. The resulting equations of a more complete aerodynamic analysis of spinning disks, cones, and cylinders at arbitrary angles of attack and the evaluation of these results using numerical techniques are discussed. The feasibility of measuring the rates of adsorption and desorption of neutral molecules on the satellite surface is evaluated as a possible secondary objective in the proposed atmospheric experiment. Molecular vibrations of cyclododecasulfur, S sub 12, were interferometrically measured in the far infrared using a polarized source. Author

N70-17562*# Exotech, Inc., Washington, D.C. Systems Research Div.
IMPLEMENTATION OF A CHEMICAL CONTAMINANT INVENTORY FOR LUNAR MISSIONS
Dec. 1969 34 p refs
(Contract NASw-1734)
(NASA-CR-107880; TPSR-70-07) Avail: CFSTI CSCL 22A

Detailed procedures and tasks are outlined for the processing of data which will serve anticipated needs of lunar sample investigators, consistent with the requirement that costs associated with implementation and operation of the inventory be consistent with known needs for this information. The primary tasks pertinent to this effort involved: (1) determining the availability of lunar mission vehicle documentation and the means for collecting it in a form suitable for future evaluation; (2) the collection and utilization of spacecraft trajectory parameters, landing sites, and dispersion patterns for crash and soft landings, and (3) evaluating the compatibility of required date inputs with the existing planetary quarantine information system. Author

N70-17567# Oulu Univ. (Finland). Dept. of Electrical Engineering.
MOTION OF SCINTILLATION LIMITS IN THE POLAR IONOSPHERE [BEWEGUNGEN DER SZINTILLATIONSGRENZE IN DER POLAREN IONOSPHAERE]
A. Tauriainen 1968 12 p refs In GERMAN; ENGLISH summary
(Rept-S-L-1968) Avail: CFSTI

In this report the occurrence of scintillation observed in the Faraday rotation in Sodankyla and Oulu is studied. Special attention is paid to sudden beginning of the scintillation. The observations show that the frontier of the scintillation in the polar ionosphere moves to the South before midnight and back to the north some hours later. This movement seems to have connection with similar movements of the trough in the electron content observed during the night in the auroral zone. Author (ESRO)

N70-17806# Tata Inst. of Fundamental Research, Bombay (India).
X-RAY ASTRONOMY: A REVIEW
B. V. Sreekantan *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 224-250 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

The development of optical astronomy is briefly reviewed from telescopic and spectroscopic methods, radio astronomy, infra-red and ultra-violet techniques, gamma-ray astronomy, and neutronic astronomy with emphasis on the field of X-ray astronomy. Research on X-ray intensities from far away sources found them several orders of magnitude higher than what was expected on the basis of solar X-rays; some were identified with optical counterparts others as extragalactic sources. X-ray sources are concentrated in the galactic plane but are crowded in several distinct regions. The various physical processes responsible for X-ray emission are: (1) black body radiation from an object at very high temperature (neutron star hypothesis); (2) bremsstrahlung radiation from a hot thin plasma; (3) synchrotron radiation from high energy electrons moving in magnetic fields; and (4) inverse Crompton effects. G.G.

N70-17807# Tata Inst. of Fundamental Research, Bombay (India).
COSMIC ELECTRONS
S. A. Stephens *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 251-267 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

This survey contains existing data on primary electrons and results from an experiment for obtaiing electrons above 50 GeV to: (1) establish reliable energy spectra of cosmic electrons; and (2) determine the charge ratio as a function of energy. Results are used to form several models for anelectron equilibrium spectra in interstellar space and the confinement of cosmic rays. From the various models presented, the one considered most likely confines near earth electrons to the Galactic Diac and considers the entire interstallar spectrum as the injection spectrum. The flattening of the spectrum below about 2 BeV is attributed to modulation effects in the source region. G.G.

N70-17808# Tata Inst. of Fundamental Research, Bombay (India).
COSMIC RAY ELECTRONS IN THE GALAXY
K. C. Anand, R. R. Daniel, and S. A. Stephens *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 268–270 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Results from many radio sky surveys are used to construct the radio brightness distribution in the following galactic directions: (1) galactic anticenter; (2) galactic ridge; (3) north galactic halo; and (4) halo minimum. Quantitative correlation of cosmic ray electron energy spectra and cosmic synchrotron emission data show that the whole galactic space is filled by nearly the same intensity of electrons; there could be intensity gradients in the plane of the galactic disk from the nucleus towards the rim and also from the nucleus towards the galactic poles. G.G.

N70-17809# Tata Inst. of Fundamental Research Bombay (India).
ELECTRONS IN METAGALAXY AND THEIR IMPLICATIONS
K. C. Anand, R. R. Daniel, and S. A. Stephens *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 271–273 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Particle radiations and magnetic fields in the metagalaxy are studied in an effort to determine the origin of background X-radiation. The equilibrium spectrum of electrons required to give rise to this X-ray spectrum through inverse Compton processes is calculated and found to be a steepened one due to energy losses in metagalactic space; electrons which contribute most to X-radiation are in the energy range of 1 to ten BeV. It is shown that these electrons are of metagalactic origin and give rise to synchrotron radiation while traversing magnetic fields in the galaxy. Comparison of electron energies in galactic and metagalactic injection spectra establishes the value for the nucleonic component flux in the metagalaxy as about 80 times less than that observed near the earth. G.G.

N70-17811# Tata Inst. of Fundamental Research, Bombay (India).
PROPOSED EXPERIMENTS TO MEASURE THE SPECTRA AND TIME VARIATION OF X-RAY SOURCES
P. C. Agrawal, M. V. K. Appa Rao, S. Biswas, G. S. Gokhale, P. K. Kunte et al *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 279–282 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Proposed is a program of balloon X-ray astronomy from our equatorial launching station, Hyderabad (latitude 17.3 deg). The main advantages are reduced background X-radiation from secondary cosmic ray interactions because of the latitude effect of primary cosmic rays and the available of some of the well-known X-ray sources like the Crab, the Cygnus complex etc. almost overhead. The specific experiments planned are: (1) determination of the X-ray intensity and spectrum of Cyg-x-1 in the 20-120 kev region; (2) time variation in the intensity and spectrum of Cyg-x-1 by repeated flying of a standardized X-ray telescope; (3) determination of the high energy and of the spectrum of Sco-x-1; and (4) determination of the absolute intensities and anisotropy, if any, of the background X-radiation. Author

N70-17812# Physical Research Lab., Ahmedabad (India).
THE 0.5 MeV GAMMA RAY FLUX AT BALLOON ALTITUDES OVER 7.6 DEG N GEOMAGNETIC LATITUDE
U. R. Rao, V. S. Iyengar, and A. S. Prakasarao *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 283–286 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Balloon middle latitude measurements of the photon spectrum in the range 250 to 825 KeV are reported. Data obtained by a NaI (Tl) detector, surrounded with a charged particle coincidence shield of plastic scintillator, establish the observed energy loss spectrum after normalizing it for constant pressure. Comparison of the 7.6 deg N minimum value for the 0.5 MeV flux of 0.37 plus or minus 0.02 photons per cubic cm sec. with observed ion chamber intensity at 41 degree N geomagnetic latitude of 0.37 plus or minus 0.02 photons/ cubic cm sec. indicates that the latitude dependence of low energy gamma rays is quite small. G.G.

N70-17814# Tata Inst. of Fundamental Research, Bombay (India).
RELATIVISTIC ASTROPHYSICS AND GRAVITATIONAL COLLAPSE (REVIEW TALK)
S. M. Chitre *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 307–324 (See N70-17766 06-29)
Avail: AEC Depository Libraries

The effects of strong gravitational fields on physical processes occuring in the universe are studied by applying Einstein's theory to connect gravitational phenomena with the geometry of space-time to the stability of stellar models. Considered are quasi-stellar radio sources, gravitational collapse of supermassive stars, as well as the phenomenon of gravitational collapse in the theory of general relativity where for every collapsing body there is a critical point beyond which it is impossible to halt the collapse. G.G.

N70-17815# Tata Inst. of Fundamental Research, Bombay (India).
MAGNETOSTATIC STELLAR CORONA
S. P. Tarafdar *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 325–328 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Examined are the conditions under which a stellar corona, in the presence of a magnetic field, can be static. The stellar corona is assumed to extend by photospheric distance from the center of the star to infinity. Equations for the pressure balance and the conservation of magnetic flux are formed under conditions that: (1) pressure in finite domain should be of non-zero finite quantity and field components should be finite; and (2) pressure and field should vanish at infinite distance. It is shown that with certain temperature distributions there exists a static corona with the magnetic field; the corona without the magnetic field will also be static with the same temperature distribution, but the converse may not be true; if at a certain temperature a corona is static without the magnetic field it may not be static in the presence of the field even if the temperature remains the same. It is also shown that the sun or other stars cannot have a static corona if the energy flow is by pure thermal conduction unless the thermal conductivity is constant or increases with distance. Thus, the stellar corona cannot be constant static if the energy flow is by pure conduction, however strong the axisymmetric field may be. G.G.

N70-17816# Uttar Pradesh State Observatory, Naini Tal (India).
ON THE POSSIBLE EXISTENCE OF SH IN SOLAR ATMOSPHERE
M. C. Pande, V. P. Gaur, and B. M. Tripathi *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 329–332 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Concentrational depths curves for various diatomic and triatomic molecules were obtained for a photospheric model by evaluating the detailed dissociation equilibria of abundances prevailing in the solar system with emphasis on diatomic sulfur behavior as a function of optical depth at 5000 A. It was found that the number for SH above photosphere was more than an order of magnitude larger than that of MgH. It was also observed that the sulphus abundance from gaseous nebulae was different from that obtained from late type stars and that a molecule of the type (SH-) can explain the limb darkening in some M dwarfs. G.G.

N70-17817# Physical Research Lab., Ahmedabad (India).
SOLAR RADIO SPECTROSCOPE (FREQUENCY RANGE 40–240 MHz) AT AHMEDABAD
R. V. Bhonsle and S. K. Alurkar *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 335–339 Supported by the Dept. of At. Energy (See N70-17766 06-29)
Avail: AEC Depository Libraries

The present communication describes briefly the solar radio spectroscope (frequency range 40-240 MHz) installed at Ahmedabad and reports preliminary observations of a few dynamic spectra of solar radio bursts recorded with it. Author

N70-17818# Tata Inst. of Fundamental Research, Bombay (India).
RAYLEIGH SCATTERING CROSS-SECTIONS OF HELIUM, CARBON, NITROGEN AND OXYGEN
S. P. Tarafdar and M. S. Vardya *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 340–343 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Calculated are Rayleigh scattering cross sections for He, C,N, and O abundances in the atmospheres of giant and supergiant stars; results are compared with corresponding absorption coefficients. Fairly good agreement between values obtained by length and velocity formalisms establishes Rayleigh scattering cross sections of He, C, N, and O as approximately in the ratio of 1:100:50:30. Photoionozation cross sections for C,N, and O extrapolated at few wavelengths and temperatures show that the Rayleigh scattering may be an important source of opacity in the atmosphere of low temperature peculiar stars. G.G.

N70-17819# Uttar Pradesh State Observatory, Naini Tal (India).
THREE COLOUR PHOTOELECTRIC PHOTOMETRY OF KP PERSEI
S. C. Joshi *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 344–346 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

The V magnitudes and the B-V and U-B indices of the Beta Canis Majoris variable KP Persei have been determined. Estimates of the interstellar reddening and the distance have been made. Author

N70-17820# Osservatorio Astronomico di Roma (Italy).
MOLECULAR RATIOS AS INDICATORS OF ELEMENTAL ABUNDANCE RATIOS
P. Giannone, N. Virgopia, and M. S. Vardya (Tata Inst. of Fundamental Res.) *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 347–394 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Molecular ratios sensitivity to elemental abundance ratios is investigated in order to determine those ratios that are more temperature than pressure sensitive as well as those more pressure than temperature sensitive for their application to spectral and luminosity classification of stars. A mixture of different ions, atoms, and molecules formed out of 15 elements in thermodynamic equilibrium is analyzed. Preliminary results indicate that not only H2O/H2, but also H2O/HON, H2O/CN, TiO/CN, and H2O/CO are good indicators of the elemental abundance ratio C / O, whereas ZrO/TiO is not a sensitive indicator. G.G.

N70-17821# Tata Inst. of Fundamental Research, Bombay (India).
ON CONVECTIVE PROCESSES IN LATE-TYPE STARS
S. M. Chitre and M. S. Vardya *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 350–352 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Drag effects on the amount of flux generated by convective processes in mixing length theory for computing stellar models are studied in order to explain the disturbed radiative equilibrium surface of late-type stars in the sub-photospheric layers. Convection is regarded as a system of ascending and descending bubbles. Eddies generated around the bubbles introduce the drag effects; the drag parameter is a function of velocity. G.G.

N70-17822# Kodaikanal Observatory (India).
ON NOVA DELPHINI 1967
A. Bhatnagar and A. T. Doss *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 353–355 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

At Kodaikanal Observatory, we have been taking observations of the brightness variation in the visual (V) and photographic (B) regions, using the 20 cm refractor in conjunction with a photoelectric photometer. Since August 26, the nova Delphini continued to remain at a magnitude around 4.7. Small scale irregular brightness variation of 0 minute .2 has been noticed after its second outburst. The color index (B-V) has remained at +0 minute .40 although a slight variation of 0 minute .03 in (B-V) is noticed. The color index +0 minute .40 of the nova corresponds to a spectral type of F4. Mean velocities obtained from hydrogen emission lines indicate a velocity recession of + 38 km/sec while emission lines of Ca2 give + 86 km/sec. Author

N70-17823# Tata Inst. of Fundamental Research, Bombay (India).
ON THE SPECTRA OF RADIO SOURCES CYGNUS LOOP AND IC 443
M. R. Kundu and T. Velusamy *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 356–361 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Presented are radio spectra of two supernovae remnants obtained by computing spectral differences between two frequencies over different regions of each source in order to obtain the flux density spectrum of one region over the entire frequency range. Curved spectra obtained for radio source regions indicate that the radiation from these regions may be originating from the source's shell; this synchrotron radiation is caused by supernovae envelope interaction with interstellar medium and shock wave propagation ahead of envelope ejection. G.G.

N70-17824# Tata Inst. of Fundamental Research, Bombay (India).
VARIATION OF ELECTRONIC CHARGE WITH COSMIC TIME
S. M. Chitre and Yash Pal *In* Dept. of At. Energy Proc. of the 10th Symp. on Cosmic Rays, Elementary Particle Phys. and Astrophys. 6 Apr. 1968 p 362–364 refs (See N70-17766 06-29)
Avail: AEC Depository Libraries

Geochronological data are used to show that the value of the square of the electronic charge was the same a billion years ago as today, provided other constants of nature are held invariant. Evaluation of alpha decay rates of uranium and K-capture rates in potassium-40 show a significant difference in sensitivity to a change in the square of electronic charge; the measured spread in ages obtained by these two methods is utilized to limit the

variation in the square of electronic charge. Since the two effects work in opposite directions, but the effect of change in alpha particle energy dominates, a lowering of the electronic charge value decreases the decay constant. A decrease of the electronic charge value towards the past thus implies that some of the meteoritic sample datings may be actually much older and the upper limit on their true age may be the accepted age of the universe. G.G.

N70-17901 Northwestern Univ., Evanston, Ill.
TWENTY-FOUR SOUTHERN PECULIAR EMISSION-LINE STARS
Eric Dungan Carlson (Ph.D. Thesis) 1968 232 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 69-6899

Observational data are presented for 24 peculiar emission-line stars located largely along the fourth quarter of the galactic equator. These rather diverse stars have one common characteristic-emission-line spectra of a type which suggests mass ejection at an extraordinary rate. The core of the group of stars may be regarded as P Cygni stars. Others were included because of their probable or possible relationship to P Cygni stars and to the problem of stellar evolution by mass ejection. Such related types include novae and nova-like stars, several unusual nuclei of planetary nebulae, symbiotic stars, peculiar binaries, unusual Bep and Of stars, and several stars so peculiar as to defy classification. The spectral data presented include line identifications, eye estimates of line intensities, and line radial velocities for absorption and emission lines and components of P Cygni lines. Dissert. Abstr.

N70-17925 Maryland Univ., College Park.
DEVELOPMENT OF A SIMPLE DIGITAL CONTROL LAW FOR SPIN PHASE SYNCHRONIZATION OF A CARTWHEEL SATELLITE IN A CIRCULAR POLAR ORBIT
James Alton Gatlin (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-7213

A simple digital control law for spin-phase synchronization of a cartwheel satellite in a circular, polar orbit is developed by presenting first a generalized analysis of a finite-memory, serially accumulated control law. Procedures for applying this class of control to any second-order, linear plant with real eigenvalues are outlined and carried out in detail for a plant described by a double integration. Using the nominal parameters corresponding to the Tiros Operational Satellite (TOS), the feasibility of spin phase-synchronization of TOS and similar satellites is established and the large-angle and steady-state performance is presented. Also some of the basic controller hardware design specifications are given. The basic significance and importance of finite-memory, serially accumulated control-law formulations and some interesting areas for future development and analysis also are discussed. Dissert. Abstr.

N70-17949# Leiden Univ. Observatory (Netherlands). Galaxies and Cosmology Div.
SECONDARY ELECTRONS IN RADIO SOURCES
G. C. Perola [1969] 13 p refs Sponsored by ESRO
Avail: ESRO

One way to produce relativistic electrons for an extended period is by means of collisions between the relativistic protons (which may be produced in a very brief interval of time) and the ambient gas. A detailed analysis is presented of the physical conditions required to explain the observations through electrons of secondary origin. The theory is able to predict the near absence of exponentially steep spectra and the presence of many convex spectra in a complete sample. However, this theory requires very dense haloes (0.1 atoms per cc) surrounding the galaxies which would produce observable effects which are not detected. Author (ESRO)

N70-17976*# Israel Program for Scientific Translations, Ltd., Jerusalem.
A COURSE IN ASTROPHYSICS AND STELLAR ASTRONOMY. VOLUME 2: PHYSICS OF STARS AND STELLAR SYSTEMS
A. A. Mikhailov et al. ed. 1969 665 p refs Transl. into ENGLISH of the book 'Kurs Astrofiziki i Zvezdnoi Astronomii' Moscow, Izd. Nauka, 1962 p 1–705 Sponsored by NASA and NSF
(NASA-TT-F-506; TT-68-50307) Copyright. Avail: CFSTI

Subject matter pertains to absolute stellar magnitude and stellar masses, binary stars, variables and novae, diffuse matter, theory of stellar atmospheres and gaseous nebulae, and stellar systems. For individual titles, see N70-17977 through N70-17981.

N70-17977*# Israel Program for Scientific Translations, Ltd., Jerusalem.
ABSOLUTE STELLAR MAGNITUDES AND STELLAR MASSES
O. A. Melnikov *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 1–43 refs (See N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03A

Comments on the brightness and color of stars are made, and the mathematical computation of absolute stellar magnitude, defined as the apparent magnitude at a standard distance of 10 parsecs which corresponds to a parallax of 0 in. 1, is given. Also included are procedures for obtaining the bolometric correction, equal to the difference between the visual magnitude and the bolometric absolute stellar magnitude. Modern color systems and interstellar absorption are also treated, as well as radiation flux and stellar brightness calculations. Finally, various methods for practical determination of absolute magnitudes are described and evaluated, followed by a discussion of the spectral classification of cold stars. A.C.R.

N70-17978*# Israel Program for Scientific Translations, Ltd., Jerusalem.
STELLAR MASSES
O. A. Melnikov *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 44–54 refs (See N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03A

Formulas for deriving component masses of binary stars are given, and techniques for studying spectroscopic and eclipsing binaries are discussed, with computed values of component masses for various stars being included. Stellar mass determination from the recordings of red shifts of spectral lines produced by the general theory of relativity is also treated; these measurements enable mass calculation for isolated, single stars. An expression for representing the mass-luminosity relation is given, and substantial deviations from the established relation are indicated as further evidence that no single model of stellar structure exists in nature which could explain the infinite variety of structure and evolution throughout the universe. A.C.R.

N70-17979*# Israel Program for Scientific Translations, Ltd., Jerusalem.
VISUAL BINARIES
In its A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 56–83 refs (See N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03A

A brief historical survey of binary star observations and related astronomical research is presented, followed by discussion of current techniques and objectives. Present double star investigations are characterized by the search for exceedingly weak low-mass companions and require high precision observations. Of considerable interest are the wide binaries, identified from their common proper motion. The use of photographic astrometry for such observations is treated and problems identified. Mention is also made of recent studies into star systems of the Trapezium type. Finally, the successful application of statistical techniques to problems involving double and multiple stars is treated. A.C.R.

N70-17980*# Israel Program for Scientific Translations, Ltd., Jerusalem.
SPECTROSCOPIC BINARIES
V. A. Krat *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 84–92 refs (See N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03B

Various methods for determining the orbital elements of spectroscopic binaries are presented. These determinations are fundamentally different from those for visual binaries in that the orbit of one or both components of spectroscopic binaries is determined relative to the center of inertia of the system. The most commonly used procedure involves construction of radial velocity curves and determination of the period. Corrections to tentative elements are obtained by the least squares method. The fundamental shortcoming of this technique is felt when the radial velocity curve is fairly uncertain; several alternatives are suggested for this situation.
A.C.R.

N70-17981*# Israel Program for Scientific Translations, Ltd., Jerusalem.
PHOTOMETRIC BINARIES (ECLIPSING VARIABLES)
V. A. Krat *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 93–138 refs (See N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03A

Characteristics of photometric binaries are described, and mathematical models of the eclipse of such stars are identified. The shape of the light variation curve depends mainly on the individual brightness of the components relative to the total brightness of the system when not in eclipse, the relative dimensions of the stars, the distance between their centers of inertia, and the inclination. Tidal forces invariably produce a certain deformation of the components, but this usually does not have a significant effect on the light curve. Three models of eliping binaries are in current use: (1) spherical stars; (2) a system of two similar ellipsoids; and (3) a sphere-elipsoid. Mention is also made of corrections to relative elements by the least squares technique and a direct method for estimating the dispersions of relative elements. Other topics include component analysis of non-stable stars, classification of close pairs, and remarks on stellar evolution in close binaries.
A.C.R.

N70-17982*# Israel Program for Scientific Translations, Ltd., Jerusalem.
VARIABLES AND NOVAE, INTRODUCTION
V. G. Gorbatskii *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 139–147 refs (See N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03A

Physical variables are defined as stars whose light variation is caused by a number of interior processes, whereas optical variables are stars whose brightness varies due to some extrinsic factor. Methods of studying physical variables involve photographic comparison by the following techniques: (1) comparison with a blink microscope; (2) superimposition of a negative on a positive photographic print taken at some other time, so that the images of variable stars appear encircled by a dark or a light fringe; and (3) use of a stereocomparator. The light curve, one of the primary characteristics of variables, is found by plotting the stellar magnitude as a function on time and can be accomplished by a number of methods. The designation and classification of stellar variables is treated, as well as mention of the existing catalogs of individual countries.
A.C.R.

N70-17983*# Israel Program for Scientific Translations, Ltd., Jerusalem.
CEPHEIDS
O. A. Melnikov *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 148–218 refs (See N70-17976 06-30)
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The following characteristics of long-period cepheid stars are treated in detail: (1) light curves; (2) spectrum variation curves; (3) radial velocity curves; (4) surface acceleration curves; and (5) line intensity curves. It is reported that few comprehensive studies of the short-period cepheids, commonly known as RR Lyrae stars, have been conducted, with the exception of investigations of their light curves. A detailed study of the long-period cepheids indicates that W Vir stars can be classified as a separate group with marked differences in basic characteristics, while some properties of Canis Majoris stars relate them to the cepheids. Finally, general distinctions of the cepheid population are identified as: (1) distribution over the sky; (2) spatial density; (3) frequency of periods; (4) motions; (5) period-spectrum relation; (6) period-density relation; and (7) period-luminosity relation. Comments on some general regularities, pulsation theory, cepheid characteristics in other star systems, and frequency of distribution for cepheids of the large sequence are also included.
A.C.R.

N70-17984*# Israel Program for Scientific Translations, Ltd., Jerusalem.
LONG-PERIOD, SEMIREGULAR, AND IRREGULAR HIGH-LUMINOSITY VARIABLES
V. G. Gorbatskii *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 219–237 refs (See N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03A

Long-period stars account for 25% of all listed variables and are classified as such when the light variation period is over 70 days, and the spectrum shows bright hydrogen lines near the maximum. Methods of determining the light curves and absolute magnitude of these stars are treated. Spectral characteristics of semiregular variables, or RV Tauri stars, are described, and a distinctive feature is identified as the alternation of deep and shallow minima on the light curve. Nonuniformities found in the spectral characteristics and motion of the RV Tau variables suggest that they include stars of different stellar populations. Finally, a discussion is included on stars whose light curves are basically similar to those of the RV Tau variables, but which show more frequent brightness irregularities, with the corresponding periods being substantially longer. These are spectral types F, G, or K and are therefore called yellow semiregular variables. They are akin to RV Tau stars in a number of spectral features, and lack of exact criteria for differentiating between the two has resulted in a rather arbitrary classification.
A.C.R.

N70-17985*# Israel Program for Scientific Translations, Ltd., Jerusalem.
LOW AND MEDIUM LUMINOSITY VARIABLES
V. G. Gorbatskii *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 238–250 refs (See N70-17976 06-30)
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Variable stars whose luminosity is low at all phases of the light curve, or at least in the minimum, are treated. Observations of such stars are highly complex, because of the luminosity and generally irregular light variation. Although only limited information exists, findings have led to the conclusion that T Tau stars cannot be older than a few million years and that T Tau, UV Cet, and some other variables have a partly nonthermal origin of radiation. For this reason, studies of variable dwarfs are of primary importance to astrophysicists, mainly in connection with stellar evolution problems. The spectral characteristics and brightness of these low and medium luminosity variables are described and the differences between them noted.
A.C.R.

N70-17986*# Israel Program for Scientific Translations, Ltd., Jerusalem.
STARS WITH VARIABLE SPECTRA
B. A. Vorontsov-Velyaminov *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 251–256 refs (See

N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03A

A discussion is presented on hot stars with changing bright lines in their spectra, stars surrounded by a tenuous absorbing envelope, and stars with variable magnetic fields. O, B, and A stars, numbering over 1000, show bright spectral lines, although in many cases these lines appear and disappear after a few years. Variations in line broadening, rotation velocities, and problems related to the continuous spectrum of these stars are mentioned. In some a dense extended envelope may naturally emit on its own in the continuum. This is superimposed on the emission spectrum of the star and thus distorts the energy distribution, making the star appear redder. Possible origins of this phenomenon are given, as well as examples of typical stars in the group. Finally, periodic variations in the spectrum of stars with variable magnetic fields are described. A.C.R.

N70-17987*# Israel Program for Scientific Translations, Ltd., Jerusalem.
NOVAE, SUPERNOVAE AND NOVA-LIKE STARS
In its A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 257–291 refs (See N70-17976 06-30)
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Typical novae are variable stars with a light variation amplitude of no less than 7 to 8 mag which are definitely supergiants at the maximum. The novae only flare once; after the outburst, they return to their initial brightness. The characteristic nova spectrum varies in close relation to the phase of the light curve. Recurrent novae are similar with regard to the variation of their magnitude and spectrum but have been observed to flare at least twice. Supernovae are flaring stars not unlike the typical novae, but their maximum luminosity is much higher than that of the most luminous supergiants and novae. Their light variation amplitude is uncertain, but should be extremely great, and it has not yet been determined whether these stars constitute a direct continuation of the brightest typical novae or should fall into an independent category. Nova-like stars are variables which, irrespective of their spectra, reveal occasional flares of any amplitude. Ordinary stars with spectra showing some of the bright lines or bands observed in one of the nova phases may also be classified in this group. A.C.R.

N70-17988*# Israel Program for Scientific Translations, Ltd., Jerusalem.
GASEOUS NEBULAE
B. A. Vorontsov-Velyaminov *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 293–319 (See N70-17976 06-30)
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A description is given of gaseous planetary nebulae, and it is indicated that there are over 600 known nebulae of this type, each showing a moderate concentration toward the galactic plane similar to the novae. They are greatly concentrated toward the center of the galaxy, again like novae, and are probably part of the constitution of the galactic nucleus. In globular clusters, there is one known nova and one known planetary nebula. The following topics related to this type of diffuse matter are treated in detail: (1) nebular spectra and light characteristics; (2) distances, sizes, luminosities, and spatial structure; (3) nature of the nuclei; (4) emission nebulae and hydrogen fields; (5) nature and existence of interstellar gas, including theoretical division into H1 and H2 regions according to the state of hydrogen within the gas; and (6) radio observations of gaseous diffuse matter. A.C.R.

N70-17989*# Israel Program for Scientific Translations, Ltd., Jerusalem.
DUST NEBULAE
B. A. Vorontsov-Velyaminov *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 320–330 refs (See N70-17976 06-30)
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Galactic nebulae are divided into gaseous and dust nebulae in terms of their physical nature. Dust nebulae are either bright or dark, but they all have an irregular, diffuse outline. Studies of interstellar absorbing dust are mainly concerned with the following topics: (1) dependence of absorption on wavelength; (2) determination of absorption at various wavelengths, in varying directions and distances from the earth; (3) determination of distances, sizes, and structure of the dense dark nebulae; (4) elucidation of the spatial distribution of dust in galaxies and in intergalactic space; (5) analysis of the interaction of interstellar dust with diffuse gas and with stars; (6) and the ability of dust particles to grow. Knowledge of the absorption as a function of wavelength is highly significant, since absorption is generally measured only for a certain region of the spectrum, whereas actual observations of stars are carried out at different wavelengths. This dependence furthermore constitutes a virtually unique fingerprint of the absorbing particles. Author

N70-17990*# Israel Program for Scientific Translations, Ltd., Jerusalem.
STELLAR PHOTOSPHERES
V. V. Sobolev *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 332–356 refs (See N70-17976 06-30)
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Analysis of the photospheric radiation field, particularly identification of the energy distribution in the continuous stellar spectrum, is stressed as the primary objective of theoretical studies. The fundamental assumptions of the theory of stellar photospheres are: (1) The photosphere has no energy sources and sinks. (2) Energy is transferred from the stellar interior to the outside by means of radiation. (3) The star is in a stationary state. A medium in which the above assumptions hold true is said to be in radiative equilibrium, and the theory based on them is called the theory of radiative equilibrium. A detailed description and analysis of the fundamental equations that relate exclusively to this theory in stellar photospheres is given. Mention is also made of the theoretical allowance for a frequency-dependent absorption coefficient and the structure of stellar photospheres, as affected by the variation of temperature and density with growth. A.C.R.

N70-17991*# Israel Program for Scientific Translations, Ltd., Jerusalem.
STELLAR ATMOSPHERES
V. V. Sobolev *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 357–391 refs (See N70-17976 06-30)
Copyright. Avail: CFSTI CSCL 03B

A basic model of the stellar envelope is described in which the outermost layers of the star are divided into two components, the photosphere and the atmosphere. The photosphere limits continuous radiation, without any absorption lines; it is on passing through the atmosphere that the stellar spectrum develops these lines. Formulas are derived to analyze the following aspects of stellar atmospheres: (1) equivalent line width as a function of the number of absorbing atoms; (2) chemical composition of the atmospheres; and (3) line broadening phenomena. A more sophisticated model is then developed in which each unit volume is regarded as absorbing and emitting energy in both the continuous and line spectrum, and the discussion of absorption lines is continued, including calculation of the central intensities of absorption lines using both models and analysis of the possible effects of incoherent scattering on these intensities. A.C.R.

N70-17992*# Israel Program for Scientific Translations, Ltd., Jerusalem.
GASEOUS NEBULAE
V. V. Sobolev *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 392–423 refs (See N70-17976 06-30)
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The origin of nebular light is discussed, and it is indicated that the energy emitted by the gaseous nebulae is concentrated

predominantly in discrete spectral lines. Despite this condition, nebular luminosities are exceedingly high, with the emission being excited by stars when the nebula absorbs the high frequency stellar radiation and converts it into quanta of lower frequencies, particularly visible quanta. Formulas are derived for considering the properties of radiation reaching a given point in the nebula from the exciting star and for determining stellar temperatures. It is noted that the spectra of gaseous nebulae show numerous forbidden lines, a condition that is not present in ordinary stellar spectra, and an indication is given of the cause of their existence. Finally, expressions are developed for calculating nebular masses, densities, and chemical composition. A.C.R.

N70-17993*# Israel Program for Scientific Translations, Ltd., Jerusalem.

STARS WITH BRIGHT SPECTRAL LINES

V. V. Sobolev *In its* A course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 425–442 refs (See N70-17976 06-30)

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A discussion is presented on early-type stars whose spectra show exceedingly bright emission lines, as contrasted with normal stars. Treatment is limited to Wolf-Rayet, P Cygni, and Be stars, since this group has been studied in much greater detail than other stars with bright spectral lines. Mention is also made of some late-type stars, such as long-period variables, and Z Andromedae stars, as well as some late dwarfs with emission lines in their spectra. A.C.R.

N70-17994*# Israel Program for Scientific Translations, Ltd., Jerusalem.

STELLAR STATISTICS. GALACTIC STRUCTURE

V. V. Sobolev *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 443–498 refs (See N70-17976 06-30)

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Galactic concentration, a characteristic feature of all objects in the earth's galaxy, is discussed, and it is indicated that the number of stars per unit sky area increases with nearness to the Milky Way. A method of defining a galactic system of coordinates is described which utilizes the position of the galactic equator in the equatorial coordinate system. Expressions are derived by which the luminosities and absolute stellar magnitudes are determined, thus allowing construction of a spectrum-luminosity diagram for stars of various spectral types. Since a close statistical correlation is observed between stellar luminosities and masses, the same type of diagram can be constructed for the mass-luminosity relationship. A table showing the total number of stars in the galaxy is given which shows that the bulk of stars are concentrated in the zone adjoining the galactic plane. The theory of field brightness fluctuations is discussed, and surface brightness fluctuations are computed. Finally, the main features of galactic structure are considered, with emphasis on subsystem populations, and spiral and radio structure. A.C.R.

N70-17995*# Israel Program for Scientific Translations, Ltd., Jerusalem.

STELLAR MOTIONS

A. N. Deich et al *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 499–548 refs (See N70-17976 06-30)

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Expressions are derived for determining the following aspects of stellar motion: (1) spatial velocity components; (2) secular variation of proper motion, parallax, and radial velocity due to stellar motion in space; (3) statistical relations between the mean spatial velocity of a star and its radial and tangential components; (4) proper motion components; (5) average secular and annual parallaxes; (6) determination of the sun's apex and elements of its motion; (7) distribution of residual velocities and the centroid velocities of the sun and stars; (8) asymmetry of stellar motions and the effect of galactic rotation; (9) the differential field of centroid velocities and the centroid field for pure galactic rotation; and (10) determination of galactic rotation from radio observations. A.C.R.

N70-17996*# Israel Program for Scientific Translations, Ltd., Jerusalem.

STELLAR DYNAMICS

T. A. Agekyan *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 549–600 refs (See N70-17976 06-30)

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Stellar dynamics is defined as the study of the regular features of motion in star systems and the effect of this motion on the evolution of the systems. The regular gravitational field, that set up by an artificially smoothed, uniform distribution of matter in the system, and the irregular field, derived as the difference between the actual field and its regular field, are analyzed theoretically. It is shown that the combined effect of irregular and regular forces moves the system through a succession of equilibrium states, referred to as a quasi-stationary state. Mention is also made of the evolution of dissipating stellar systems, as well as the evolutionary general features when dissipation is ignored. A.C.R.

N70-17997*# Israel Program for Scientific Translations, Ltd., Jerusalem.

STAR CLUSTERS

T. A. Agekyan *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 601–630 refs (See N70-17976 06-30)

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Star clusters, systems containing more numerous stars than other stellar combinations and characterized by a more complex structure, are considered as two main types, open and globular, that differ greatly in physical properties. Discussion of open clusters, often called galactic clusters, includes treatment of their basic characteristics, as well as descriptions of moving clusters and stellar associations. Globular clusters are incomparably richer in stars than open clusters and have regular spherical shape. Spectral characteristics, density functions, and methods of determining distances of globular clusters are treated in detail. Finally, the general stability of star clusters is analyzed. A.C.R.

N70-17998*# Israel Program for Scientific Translations, Ltd., Jerusalem.

EXTRAGALACTIC ASTRONOMY

T. A. Agekyan *In its* A Course in Astrophys. and Stellar Astronomy, Vol. 2 1969 p 631–705 refs (See N70-17976 06-30)

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A discussion of Hubble's classification system, which divides galaxies into regular and irregular types, is presented, as well as his methods for correct determination of extragalactic distance. The apparent magnitudes, absolute magnitudes, diameters, and surface brightness of the 20 most luminous galaxies are also tabulated, and Morgan's classification of spectra, color indices, and stellar populations of galaxies is presented. Other topics include: (1) the frequency of galactic types; (2) red shift in galactic spectra; (3) revision of the extragalactic distance scale; (4) rotation of galaxies and mass determination from rotation data; (5) description of the Magellanic Clouds and the Andromeda Nebula; (6) double and multiple galaxies; (7) galaxy clusters and methods for their mass determination; and (8) the hypothetical system which combines all observed galaxies, known as the Metalaxy. It is assumed that the entire observable part of the universe is the interior of the Metagalaxy. A.C.R.

N70-18019# Smithsonian Astrophysical Observatory, Cambridge, Mass.

PUBLICATIONS OF THE CENTRAL BUREAU FOR SATELLITE GEODESY. VOLUME 5: BIBLIOGRAPHY ON SATELLITE GEODESY AND RELATED SUBJECTS

Jan Rolff, Barbara Alpern, and Lienna Pizer Nov. 1969 58 p refs *Its* Bibliography No. 5
Avail: CFSTI

A bibliography on satellite geodesy and related topics on geophysics and celestial mechanics is presented. Satellite observations of geodetic importance, results derived from such observations, and other information of interest to those working in the field of satellite geodesy are contained in the publications. Author

N70-18034*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMPLE METHOD OF USING ONBOARD OPTICAL MEASUREMENTS TO PREDICT THE ORBIT ESTABLISHED AFTER THE LUNAR-ASCENT-TRANSFER ORBIT
L. Keith Baker and Herman S. Fletcher Washington Feb. 1970 22 p refs
(NASA-TN-D-5618; L-6680) Avail: CFSTI CSCL 22C

An analytical study was made to develop a single procedure for determining the apocynthion and pericynthion altitudes of the orbit established after ascent from the lunar surface. The procedure consisted of measuring the angle between the line of sight to the sun and that to the lunar horizon at two specified times on the established orbit and then predicting the altitudes graphically from these angular measurements. The effects of errors on the procedure were examined, and it appears that the technique would be useful for predicting the apocynthion and pericynthion altitudes of the established orbit. Author

N70-18144# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
CONCERNING THE GENEALOGY OF LONG PERIOD FAMILIES AT L SUBSCRIPT 4
Jacques Henrard Sep. 1969 28 p refs *Its* Mathematical Note No. 621
(AD-697118; DI-82-0910) Avail: CFSTI CSCL 3/3

The family of long period orbits at L sub 4 does not evolve in a continuous manner with the mass ratio. Discontinuities appear not only at the mass ratios for which the long period at the equilibrium is a multiple of the short period, but also at mass ratios where the global analysis of the family detects singular bifurcation orbits. Extended numerical continuations carried with very great accuracy enable us to follow the evolution of the long period family from the inner resonance 1/4 to the inner resonance 1/1 through collapses at the equilibrium, mergers with bridges and redistribution of branches. The study stresses the extreme complexity of the phase space around an equilibrium for a one-parameter family of conservative Hamiltonian systems with two degrees of freedom. Author (TAB)

N70-18149 California Univ., Los Angeles.
ON OPTIMUM CONTROL SYSTEMS WITH VARIATIONS IN INITIAL CONDITIONS
Cheng-An Wu (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-5360

The effect of changes in initial conditions of the trajectories of the control systems described by a set of ordinary nonlinear differential equations are considered. The analysis is based on the formation of sensitivity functions about the nominal trajectory. Sensitivity functions are used to investigate the changes in terminal conditions and the cost function due to deviations in initial conditions. Bounds on the deviations in initial conditions are found so that the desired terminal conditions are satisfied within given tolerances. The Mars entry problem is formulated. A nominal trajectory which is optimum with respect to minimizing quadratic form of control variable is obtained by the use of the conjugate gradient method. A simple feedback control scheme called adaptive lamda matrix control is employed to take care of deviations in initial condition and uncertainty in Martian atmosphere, so that the deviation in final altitude is minimized. Dissert. Abstr.

N70-18171# Texas Univ., Austin.
NUMERICAL STUDIES OF SOLAR INFLUENCE PARTICLE MOTION NEAR THE TRIANGULAR EARTH-MOON LIBRATION POINTS
B. E. Schultz and B. D. Tapley 1969 27 p refs Presented at the Symp. on Periodic Orbits, Stability and Resonances, Sao Pauli, Brazil, 4-12 Sep. 1969
(Contract N00014-67-A-0126)
(AD-696595) Avail: CFSTI CSCL 3/3

The equations of motion of the restricted problem of four bodies were numerically integrated using the Jet Propulsion Laboratory Ephemeris Tape E9511 to provide the positions of the three primaries, viz., earth, moon, and sun. Using initial conditions for the particle which satisfied the elliptic restricted problem of three bodies (earth, moon, and particle), the numerical results of the restricted problem of four bodies indicate that a particle placed at L sub 5 on Julian Ephemeris Date 2,439,796.735 will follow a libration-point-centered motion for 2500 days. The envelope of the particles motion about L sub 5 expands and contracts with a period of approximately 750 days. Additional numerical computations indicate that the motion will persist for a period in excess of 5000 days. For the same initial date, a near lunar encounter occurs at 579 days for a particle placed at L sub 4 with initial conditions satisfying the elliptic restricted problem of three bodies. Author (TAB)

N70-18279# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE
13 Jan. 1970 52 p Transl. into ENGLISH from Russian Publications *Its* No. 220
(JPRS-49595) Avail: CFSTI

Abstracts of recent publications of the Sino-Soviet Bloc Countries are presented in astronomy, geophysics, meteorology, and aerospace sciences. Complete bibliographic information is included. F.O.S.

N70-18281# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIURNAL TEMPERATURE BEHAVIOR IN THE MARS AEROSOL-GAS ATMOSPHERE AND GROUND
V. I. Aleshin et al 1969 11 p refs Transl. into ENGLISH from Astron. Zh. (USSR), v. 46, no. 5, 1969 p 1095-1103
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The altitude distribution and diurnal changes in temperature in the aerosol-gas atmosphere and ground of Mars are computed. Atmospheric models in which the pressure at the surface is 5, 10, and 20 mbar are examined. Each model is characterized by an optical thickness due to solar radiation absorption in a dust atmosphere. It is shown that the presence of even a weak atmosphere with minimal dustiness will raise the temperature of the planet surface by 17 deg at night. For considerable dustiness, this rise can reach 30 deg. Author

N70-18288# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A METHOD OF DETERMINING THE OPTIMAL DEORBIT MANEUVER FROM A NEAR-PLANETARY ORBIT FOR A FIXED ANGLE OF ATMOSPHERIC REENTRY
S. N. Kirpichnikov 1969 14 p refs Transl. into ENGLISH from Vestn. Leningrad Univ. (Leningrad), no. 13, 1969 p 131-142
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The construction of an optimal, relative to fuel consumption, deorbit maneuver of a satellite from a near-planetary orbit is considered. The maneuver is realized by using a single impulse applied in the initial orbit, and terminates by satellite entry into the dense layers of the planet's atmosphere or by a rigid collision with the planet surface when there is no atmosphere. The initial satellite orbit, the altitude of the dense layers of the planet's atmosphere, and the angle of satellite entry into these dense layers are considered given. Author

N70-18299# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVELOPMENT OF ASTRONOMY IN THE USSR (FIFTY YEARS OF SOVIET SCIENCE AND TECHNOLOGY). VOLUME 2
A. A. Mikhailov et al 11 Apr. 1969 275 p refs Transl. into ENGLISH from Razvitie Astron. v. SSSR Sovetskaya Nauka i Tekhn. za 50 Let (Moscow), v. 1, 1967 p 1–475
(AD-696406; FTD-MT-24-186-68-Vol-2) Avail: CFSTI CSCL 03/1

Contents: Radio astronomy; Stellar cosmogony; Development of planetary cosmogony; Latest problems in planetary cosmogony; Cosmology; The study of outer space using artificial earth satellites and robot space stations; Studies in the history of astronomy; Literature. TAB

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-16905*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO/SATURN 5: LAUNCH COMPLEX 39, MOBILE LAUNCHER SERVICE ARMS, OPERATIONS AND MAINTENANCE Technical Manual
16 May 1969 181 p refs Prepared by Boeing Co.
(NASA-TM-X-64060; TM-509A) Avail: CFSTI CSCL 22D

A supplement to TM-509 is presented containing information pertinent to the operation and maintenance of the environmental chamber as installed of the Apollo/Saturn 5 Command Module Access Arm. Included in the manual are descriptions of: (1) the environmental chamber; (2) the theory of operating the pneumatic, pruge, and electrical systems; (3) the general operations, and trouble analysis; (4) special tools and equipment, and (5) maintenance procedures. F.O.S.

N70-16998*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TERRESTRIAL ENVIRONMENT (CLIMATIC) CRITERIA GUIDELINES FOR USE IN SPACE VEHICLE DEVELOPMENT, 1969 REVISION
Glenn E. Daniels, ed. 8 Sep. 1969 265 p refs Revised
(NASA-TM-X-53872) Avail: CFSTI CSCL 22B

Guidelines on probable climatic extremes and probabilities-of-occurrence of terrestrial environment data specifically applicable for NASA space vehicles and associated equipment development are presented. The geographic areas encompassed are the Eastern Test Range (Cape Kennedy, Florida); Huntsville, Alabama; New Orleans, Louisiana; the Western Test Range (Point Arguello, California); Sacramento, California; Wallops Test Range (Wallops Island, Virginia); White Sands Missile Range, New Mexico; and intermediate transportation areas. In addition, sections have been included to provide information on the general distribution of natural environment extremes in the United States (excluding Alaska and Hawaii), cloud cover, and some worldwide climatic extremes. Author

N70-17087# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
SATELLITE ASPECT AND SOLUTIONS OF SPACE PROBLEMS Final Report, 1 Jan.–31 Dec. 1968
Rene J. Marcou, Paul N. Pruneau, Robert W. Fioretti, and Leo F. Power, Jr. 31 Jan. 1969 100 p refs
(Contract F19628-68-C-0203)
(AD-696686; AFCRL-69-0377) Avail: CFSTI CSCL 22/1

The computation of meaningful aspect parameters for each OV3-6, OV1-15, and OV3-2 orbit of interest was accomplished by using a general aspect analysis and computer programs. Author (TAB)

N70-17089# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
PILOT EXTERNAL VISIBILITY CRITERIA AND DESIGN AIDS Final Technical Report, 1 Jul. 1968–1 Dec. 1967
Edward O. Roberts Sep. 1969 76 p refs
(AD-697024; AFFDL-TR-69-33) Avail: CFSTI CSCL 22/2

Several factors influencing external visibility criteria for aerospace vehicles are discussed. Design aids and tools are developed to aid the crew station designer confronted with providing external vision. A computer program is listed for generating various visibility plots on a CALCOMP or a SC-4020 cathode-ray tube plotting machine. Transformation information is presented to plot planar windows formed from straight lines and/or circles. To show the application of the design aids and the computer program, a conceptual high L/D lifting body vehicle configuration was used throughout the report as an example. Author (TAB)

N70-17124# Royal Aircraft Establishment, Farnborough (England). Space Dept.
THE BLACK ARROW SATELLITE LAUNCHING VEHICLE
Apr. 1969 76 p
(RAE-TR-69068) Copyright. Avail: CFSTI

The Black Arrow satellite launching vehicle currently being developed as part of the United Kingdom national space program is described. The assistance of the various contractors associated with Black Arrow is acknowledged in this general technical description and its operational procedure. Author (ESRO)

N70-17219# Observatoire de Paris (France).
ARTIFICIAL SATELLITES: OBSERVATIONS MADE AT STRASBOURG, 1 JUNE 1964–31 DECEMBER 1965; ECHO AND OTHERS [SATELLITES ARTIFICIELS: OBSERVATIONS FAITES A STRASBOURG, 1 JUIN 1964–31 DECEMBRE 1965; ECHO ET DIVERS]
Paul Muller 1969 127 p In FRENCH; ENGLISH summary
Sponsored by CNES *Its* Publ. 23
Avail: CFSTI

The observations include 3072 points obtained during 740 transits. The transits of Echo and other artificial satellites are given in chronological order with the following data: hours, minutes, seconds, tenths, and hundredths (universal time); azimuth (from south towards west) in degrees and minutes; elevation in degrees and minutes, corrected for refraction; right ascension in degrees and hundredths; declination in degrees and hundredths. The equatorial coordinates are referred to the equinox of the date. ESRO

N70-17240# Observatoire de Paris (France).
ARTIFICIAL SATELLITES: OBSERVATIONS MADE AT STRASBOURG (11 NOVEMBER 1961–31 MAY 1964; ECHO AND OTHERS) [SATELLITES ARTIFICIELS: OBSERVATIONS FAITES A STRASBOURG (11 NOVEMBRE 1961–31 MAI 1964; ECHO ET DIVERS)]
Paul Muller 1969 127 p In FRENCH; ENGLISH summary
Sponsored by CNES *Its* Publ. no. 22
Avail: CFSTI

The observations made at Strasbourg during November 1961 to May 1964 include 4031 points obtained during 511 transits. The transits for Echo and other artificial satellites are given in chronological order with the following data: hours, minutes, seconds, tenths, and hundredths (universal time); azimuth (from south towards west) in degrees and minutes; elevation in degrees and minutes, corrected for refraction; right ascension in degrees and hundredths; and declination in degrees and hundredths. The equatorial coordinates are referred to the equinox of the date. ESRO

N70-17261# Observatoire de Paris (France).
ARTIFICIAL SATELLITES: OBSERVATIONS MADE AT BESANCON (1 JULY 1963–14 APRIL 1964; ECHO AND OTHERS) [SATELLITES ARTIFICIELS: OBSERVATIONS FAITES A BESANCON (1 JUILLET 1963–14 AVRIL 1964; ECHO ET DIVERS)]
Paul Muller 1969 120 p In FRENCH; ENGLISH summary
Sponsored by CNES *Its* Publ. 24
Avail: CFSTI

The observations include 3977 points obtained during 415 transits. The transits are given in chronological order with the following data: hours, minutes, seconds, tenths, and hundredths (universal time); azimuth (from south towards west) in degrees and minutes; elevation in degrees and minutes, corrected for refraction; right ascension in degrees and hundredths; declination in degrees and hundredths. The equatorial coordinates are referred to the equinox of the date. ESRO

N70-17290*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT SIMULATION TESTS OF A CENTAUR VEHICLE IN A SPACE CHAMBER
Ralph F. Schmiedlin, Robert J. Turek, B. J. Dastoli, Glen M. Holtz, and Lawrence J. Ross Washington Jan. 1970 64 p refs
(NASA-TM-X-1929) Avail: CFSTI CSCL 22B

As part of an extensive ground test program, the Centaur, a hydrogen–oxygen second stage rocket vehicle, was installed in an environmental space chamber and operated electrically in a series of simulated flight tests. Twenty five 1-hour low orbital missions that included 25 minute coast periods were simulated at various flight conditions. Secondary tests were performed to investigate effects on system operation of (1) leakage in sealed subsystem canisters, (2) canister internal heat transfer at simulated zero gravity, and (3) variation of radiant heat input with time. This report describes the test procedures, simulation techniques, and typical results obtained during these flight simulation tests. Included is a unique method of determining test values of radiant thermal input by use of a one-quarter scale model. Author

N70-17350*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 SPACECRAFT DESTRUCT UNIT
D. P. Davis and F. L. Sola 15 Nov. 1969 13 p refs
(Contract NAS7-100)
(NASA-CR-107846; JPL-TM-33-448) Avail: CFSTI CSCL 22B

To conform to national range safety polices, the Mariner Mars 1971 spacecraft must have a vehicle destruct capability. This report describes a test program to evaluate the use of the Surveyor flight qualified destruct unit as the basis for the Mariner Mars 1971 design. The critical performance factors are the conical shaped charge standoff distance, which is 8 in for the Surveyor vs approximately 70 in for the Mariner, and the additional requirement of penetration of the Centaur thermal bulkhead in the Mariner configuration. After a series of flatplate tests to assess the distance performance of the shaped charge and the attenuating effect of a honeycomb panel mounted between the target plate and the shaped charge, a pressurized tank test was conducted to simulate the actual destruction of a flight propellant tank. The tests demonstrated that the increased distance from the conical shaped charge to the target does not reduce its destruct capability, and that it is feasible to use the Surveyor design for the Mariner Mars 1971 destruct requirements. Author

N70-17356*# International Business Machines Corp., Cape Kennedy, Fla. Federal Systems Div.
ORBITAL/GROUND CHECKOUT STUDY Final Technical Report
H. J. Bellamy 17 Nov. 1969 278 p refs
(Contract NAS10-6376)
(NASA-CR-107230; IBM-69-M91-001-CKF) Avail: CFSTI CSCL 22B

This conceptual study analyzed the checkout and data management system requirements anticipated for the 1975-85 space station space base program. A 1986 Mars mission was also considered. In the light of expected technology advances, system concepts (both onboard and ground based) were developed to satisfy the expected requirements. An implementation plan for the preferred concept of the ground based system is presented. Author

N70-17384# Royal Aircraft Establishment, Farnborough (England).
THE UK3 SPACECRAFT SUPPORT STING BUILT FOR THE RAE 2.5 M SPACE TEST CHAMBER
R. D. Swift Jun. 1969 18 p
(RAE-TR-69124) Copyright. Avail: CFSTI

Details are given of the design and construction of the sting used to support UK3 during its solar simulation and thermal vacuum testing. The sting served to convey hard line data from the rotating spacecraft through the spin motion bearing to the fixed wiring on the quadrant arm. Author (ESRO)

N70-17372*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF REALISTIC VIBRATION TEST LEVELS FOR SOUNDING ROCKET SUBSYSTEMS
Ronnie L. Kinsley Sep. 1969 50 p
(NASA-TM-X-63798; X-321-69-474) Avail: CFSTI CSCL 22B

Sounding rocket subsystems are currently vibration tested to the same exposure levels as the payload, a process which ignores the transmissibility of the payload structure. This is done because specific transmissibility data is not available for each of the hundreds of sounding rockets launched each year. An investigation was undertaken, using the NIKE-APACHE rack as a typical example, to determine whether transmissibilities fall within a predictable range when certain key parameters (weight and c.g. location) are varied. If so, subsystem specifications having predictable tolerances could be developed which would take into account the transmissibility and thus be superior to current specifications which ignore transmissibility entirely. Using a combination of analytic and experimental techniques, it is shown that this can be done, and furthermore specific recommendations for modifications of system level specifications are made for the testing of NIKE-APACHE subsystems. Author

N70-17391*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
CONSIDERATIONS ASSOCIATED WITH THE DESIGN OF THE THERMAL SUBSYSTEM OF THE ORBITING ASTRONOMICAL OBSERVATORY
Stanford Ollendorf and Michael J. Coyle, Jr. Dec. 1969 23 p refs
(NASA-TM-X-63802; X-713-69-552) Avail: CFSTI CSCL 22B

The programs and studies developed for analyzing the thermal design of the OAO are presented. Included are: a flux study, with blockage, to define the environment, an active control tradeoff study to define the use of louvers versus heaters, and a comprehensive 350-node model of the spacecraft and Experiment Optical package. The computer program for the flux study included, for the first time, a blockage routine which handled solar, albedo, and earth fluxes. With regard to the experiments, the models developed were the first to predict to within 5 C critial areas of the optical packages. Six-month flight data illustrating the actual versus predicted temperatures in the spacecraft and experiment are presented. An examination of preflight thermal constraints is made. Their ultimate relaxation as a result of the flexibility found to exist in the spacecraft under abnormal conditions in orbit is discussed. A comparison is made of in-flight degradation of the Alzak to that measured in ground testing and previously flown on the ATS-3 reflectometer experiment. Author

N70-17401*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 11 MISSION REPORT
Nov. 1969 340 p refs
(NASA-TM-X-62633; MSC-00171) Avail: CFSTI CSCL 22A

The Apollo 11 mission including: preflight, launch, trajectories, undocking and separation, lunar surface operations, rendezvous, reentry, and recovery are reported. All actual times are elapsed time from range zero established as the integral second before lift-off which was 13:32:00 G.M.T., July 16, 1969. Only one midcourse correction, performed after 27 hours elapsed time was required during translunar coast. It is concluded that the Apollo 11 mission, including the manned lunar landing and surface exploration was conducted with skill, precision, and relative ease. The excellent performance of the spacecraft and the thorough planning in all aspects of the program permitted the safe and efficient execution of the mission. F.O.S.

N70-17402*# Bellcomm, Inc., Washington, D.C.
OPTIMAL CONTROL FOR A ROCKET IN A THREE-DIMENSIONAL CENTRAL FORCE FIELD
T. L. Yang 29 May 1969 55 p refs
(Contract NASw-714)
(NASA-CR-107866; TM-69-2011-2) Avail: CFSTI CSCL 22A

A fuel optimum solution for a rocket in a drag-free central force field is presented. The solution is restricted to powered flights in which the maximum position change is small compared with the distance from the center of the force field. This condition is satisfied by most powered maneuvers currently being utilized in space trajectories. First, the solution of the problem in a unifrom force field is obtained using Pontryagin's principle in the optimal control theory. A perturbation technique is then used to solve the central force field problem. The introduction of the perturbation technique makes the differential equations integrable, but at the same time imposes the position change restriction. Because of the lengthy form of the integrals obtained, a numerical method is recommended for evaluating the integration constants. Author

N70-17409# European Space Research and Technology Center, Noordwijk (Netherlands).
PROJECT DEVELOPMENT PLAN FOR THE HEOS-A2 SATELLITE
R. X. L. Collette *In* ELDO/ESRO Tech. Rev., Vol. 1, No. 3 1969 p 337–362 (See N70-17406 06-34)
Avail: CFSTI

HEOS-A2 is highly-eccentric-orbit satellite scheduled for launch towards the end of 1971. It will orbit into a region of space where no satellite has yet flown. The primary scientific mission is the investigation of interplanetary space and of the high-latitude magnetosphere and its boundary, in the region around the northern neutral point. It will carry seven experiments designed to carry out particle, magnetic field and solar wind measurements, solar VLF observations, and micrometeorite detection. The basic design of the spacecraft and its sub-system is outlined as well as the ground support required, and development, management, and contractural proposals are summarized. Author (ESRO)

N70-17410# Hawker Siddeley Dynamics, Ltd., Stevenage (England). Space Div.
PERFORMANCE OPTIMISATION STUDY OF THE TWO STATE SATELLITE LAUNCHING VEHICLES
G. J. N. Smith *In* ELDO/ESRO Tech. Rev., Vol. 1, no. 3 1969 p 363–383 refs (See N70-17406 06-34)
Avail: CFSTI

Optimum configurations and trajectories are examined for the liquid hydrogen and liquid oxygen propelled upper stage of a two-stage vehicle based on an ELDO A first stage (Blue Streak). Various orbital missions are also considered. ESRO

N70-17551*# Houston Univ., Tex. Faculty Systems Engineering Inst.
LLV: LUNAR LOGISTICS VEHICLE Final Report
Frederic M. Davidson, and Steve Dickerson, eds. Sep. 1969 395 p refs Prepared in cooperation with Rice Univ.
(Contract NSR-44-005-059)
(NASA-CR-102078) Avail: CFSTI CSCL 22B

The preliminary design of an unmanned space vehicle that can land a payload of 2500 pounds on the moon is presented. The design is based on a maximum use of developed, space qualified hardware so that the vehicle can be made operational by 1973. The Titan III-D Centaur will be the launch vehicle. This booster combination can insert a 12,000 pound spacecraft into a translunar trajectory. Total program costs for an eight mission program would be approximately $400,000,000, exclusive of payload costs. Lunar touchdown 3-sigma landing dispersions of one kilometer relative to targeted geological features anywhere on the visible face of the moon are proposed. These can be obtained with the use of direct descent trajectories and terminal guidance corrections based on remote television transmissions. The vehicle can be safely landed in lunar slopes of up to 35 degrees with the aid of low touchdown velcotiies, hold-down rockets, and a four-pad landing gear. Retro propulsion is provided by a main cryogenic stage that consists of a Pratt & Whitney RL-10A-3-3 engine, and is jettisoned after burnout at low altitude. Author

N70-17602*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SATURN S FLIGHT MANUAL, SA 507
15 Aug. 1969 229 p refs Revised
(NASA-TM-X-62634; MSFC-MAN-507) Avail: CFSTI CSCL 22D

The manual provides general mission and performance data, emergency detection system information, a description of each stage and the IU, and a general discussion of ground support facilities, equipment, and mission control. A bibliography identifies additional references if a more comprehensive study is desired. Major hardware associated differences between the Saturn V launch vehicles SA-506 through SA-509 are annotated in the manual. They are identified by reference numbers in the margin adjacent to the new information. These reference numbers refer to footnotes which are located at the end of each section. Author

N70-18289# Joint Publications Research Service, Washington, D.C.
OPTIMUM FORMS OF SPACE TRIANGULATION FIGURES
B. M. Klenitskiy 12 Dec. 1969 17 p Transl. into ENGLISH from Geodiz. i Kartograf. (Moscow), Jan. 1968 p 7–18
(JPRS-49432) Avail: CFSTI

Mathematical expressions are presented for determining the optimum form and size of triangulation figures and optimum satellite height. The dependence of optimum chord length and ranges on satellite height is illustrated. Two groups of triangulation rows are described: a series of successive elementary figures in which each new station is determined from the two preceding stations, and rows of successive pairs of elementary figures in which each pair of new stations is determined from the two preceding stations. It is determined that for a world network with sides 1500 to 2000 km long the optimum satellite altitude is 800 to 1000 km; for a network with 3000 to 4500 km sides the satellite altitude is 2500 km; and for a network with 7000 km sides the optimum satellite altitude is 10,000 km. It is also pointed out that an increase in satellite altitude results in an increase in position errors. N.E.N

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-16942# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
STRESSES IN AN ELASTIC HALFSPACE DUE TO SURFACE LOADS PROGRESSING AT THE SPEED OF RAYLEIGH WAVES
Ivan S. Sandler and Hans H. Bleich Aug. 1969 30 p refs
(Contract Nonr-266(86))
(AD-696661; TR-45; CU-2-69) Avail: CFSTI CSCL 20/11

The nature of the singularity in the stresses produced near the front of a progressing step load of pressure on the surface of an elastic halfspace is investigated for the case when the velocity of the front coincides with that of Rayleigh waves in the elastic medium. The technique is based on the assumption of the basic form of the solution and the demonstration that this assumption is correct. It is found that for the particular velocity of the front considered here, unusually large stresses are produced in the medium. TAB

N70-17000*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIMPLE, SPALL, AND PERFORATION CHARACTERISTICS OF THIN PLATES OF NINE MATERIALS UNDER HYPERVELOCITY IMPACT
Nestor Clough, Seymour Lieblein, and Allen R. Mc Millan (Gen. Motors Corp., Warren, Mich.) Washington Jan. 1970 34 p refs
(NASA-TN-D-5625; E-4966) Avail: CFSTI CSCL 20K

Spherical projectiles of approximately 0.018 gram mass were accelerated to a velocity of approximately 7.6 km/sec and impacted against flat-plate targets of varying thickness in an evacuated chamber. Variations in target temperature and projectile density were included. Target thicknesses at incipient perforation and at rear-surface dimple and spall were determined for nine materials. Thickness ratios at the onset of each of the damage modes, and the corresponding mass of armor required, varied significantly with target material and temperature and with projectile material. A correlation was proposed for the variation of ratio of target thickness at perforation to projectile diameter which included the effects of projectile density and target temperature. Author

N70-17025# Air Force Missile Development Center, Holloman AFB, N.Mex.
REDUCTION OF QUASI-NONSTATIONARY RANDOM DATA USING A PEAK-AMPLITUDE FUNCTION
Artur E. Volmerig, Doyle D. Rexrode, and Larry C. Mixon Sep. 1969 49 p refs
(AD-696622; MDC-TR-69-54) Avail: CFSTI CSCL 9/4

The purpose of the report is to establish the necessity for a special editing program designed to generate a peak amplitude function and to outline the development of this program. This editing program facilitates the reduction of short time periodic modulated random functions in the frequency domain. An application of the peak amplitude function editing procedure is shown for the analysis of monorail rocket sled vibration data. Author (TAB)

N70-17065# Naval Research Lab., Washington, D.C. Ocean Technology Div.
GRAPHICAL METHODS FOR PLASTICITY CORRECTIONS IN FRACTURE MECHANICS
J. A. Kies, H. L. Smith, and F. R. Stonesifer 18 Sep. 1969 24 p refs
(AD-696933; NRL-6918) Avail: CFSTI CSCL 20/11

Fracture mechanics is an analytical procedure that relates the critical stress, critical crack dimensions, and toughness of a given material so that standards of inspection and tolerable defects may be set. Failure analysis is a relatively simple and useful application of fracture mechanics. The subject of failure prevention and reliability assurance is at least equally important, but it is complicated by present limitations on the ability of nondestructive tests to measure, with sufficient accuracy, individual small defects in specimens or in structures. The application of fracture mechanics to the study of stress corrosion cracking has led to results that are drastically changing our ideas of what is and what is not susceptible to this kind of failure. For very tough materials, i.e. those in which the plastic zone size developed at the border of a crack becomes comparable with the crack dimensions, the applicability of fracture mechanics formulas becomes uncertain. In this case, a more empirical type of evaluation based on the total work for plastic flowing may be more useful. A graphical method is proposed for making plasticity corrections so that the linear elastic equations may be applied. Author (TAB)

N70-17112*# California Inst. of Tech., Pasadena. Firestone Flight Sciences Lab.
CRACK PROPAGATION UNDER VARIABLE LOAD HISTORIES IN LINEARLY VISCOELASTIC SOLIDS
W. G. Knauss and H. Dietmann Dec. 1969 27 p refs
(Grant NGL-05-002-005)
(NASA-CR-107802; GALCIT-SM-69-13) Avail: CFSTI CSCL 20K

The growth of a crack in a viscoelastic solid is considered within the limitations of linear continuum mechanics. Starting from the local stress and deformation field at the tip of a crack and the first law of thermodynamics a non-linear differential equation is derived for the crack tip velocity in dependence on an arbitrary history of the crack tip stress intensity factor. Conditions for the simplification of this differential equation are discussed. The case of cyclic loading (fatigue problem) is discussed in detail and sample calculations are given to illustrate the relative effect of maximum and minimum load during a cycle. Some experimental data is given for comparison with these calculations. Author

N70-17175# National Materials Advisory Board, Washington, D.C.
QUANTITATIVE TECHNIQUES FOR RESEARCH PROGRAM PLANNING IN STRUCTURAL MECHANICS Final Report, Jan. – Sep. 1969
Aug. 1969 71 p refs
(Contract N00014-67-A-0244)
(AD-696974; NMAB-259) Avail: CFSTI CSCL 5/1

The Committee has concluded that systematic procedures to assess the relative importance of various subdisciplines in structural mechanics have promise as methods for providing guidance in optimizing the allocation of resources for research program formulation. Inasmuch as such procedures are not helpful in anticipating scientific breakthroughs, 25% of the overall research budget should be allocated exclusively, on the discretionary judgment of the Branch staffs members, to fundamental research which has broad promise of application to Naval missions. The matrix method is considered as the most promising planning technique. Author (TAB)

N70-17305# Southwest Research Inst., San Antonio, Tex.
STUDY OF BEHAVIOR OF GRILLAGES IN ELASTIC AND PLASTIC RANGES Final Report
Thein Wah and Robert Sherman 1 Dec. 1969 84 p
(Contract N00024-67-C-5356)
(AD-697000; Rept-03-2101-01) Avail: CFSTI CSCL 13/10

This report is concerned with an experimental evaluation of the behavior of plated grillages under the simultaneous action of a uniform normal pressure and axial compression. The combination of loads was gradually increased so as to produce large plastic deformation, the aim being to obtain an estimate of the collapse strength of the grillage. The test procedure is described and conclusions are drawn regarding the behavior of the longitudinals, the transversals, and the plating. Difficulties in the tests arising from local crippling of the stiffeners are also discussed. Author (TAB)

N70-17318*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
THE STABILITY OF CIRCULAR RINGS UNDER A UNIFORMLY DISTRIBUTED RADIAL LOAD Technical Report
Harry E. Williams 15 Jan. 1970 31 p refs

(Contract NAS7-100)
(NASA-CR-107848; JPL-TR-32-1421) Avail: CFSTI CSCL 20K

An analysis of the stability of circular rings under a uniformly distributed radial load is presented. It was found that, in general, the critical mode shapes are a combination of in- and out-of-plane displacements and that they occur at loads considerably below the classical (in-plane) critical load. The role of workless constraints was also studied. The analysis shows that workless constraints lead to an increase in the critical load. Author

N70-17403*# Texas A&M Univ., College Station.
A RAPIDLY CONVERGING TRIANGULAR PLATE ELEMENT
James A. Stricklin, Walter E. Haisler, Patrick R. Tisdale, and Richard Gunderson [1968] 9 p refs Sponsored in part by Sandia Corp.
(Grant NGL-44-001-044)
(NASA-CR-107840; SC-CR-68-3561) Avail: CFSTI CSCL 20K

A compatible triangular plate element based on a complete third order polynomial for the normal displacement and second order polynomials for the inplane displacements is presented. A nine degree of freedom element is obtained by requiring the transverse shear deformations to be zero at the nodes and along the sides of the element, and, by assuming the slope normal to the element at the middle of the side is one-half the sum of the values at the corner nodes. Neglecting the strain energy due to transverse shear the strain energy expression for the element is the same as that used in plane stress problems. The accuracy of this element representation is demonstrated by solving simply supported and clamped plates under uniform and concentrated loadings. This gives a nine degree of freedom element with zero transverse shear along the sides and along the lines from the corners to the centroid. Author

N70-17460# Southampton Univ. (England). Inst. of Sound and Vibration Research.
FREE VIBRATION OF DOUBLY CURVED RECTANGULAR PLATES INCLUDING THE PRESENCE OF MEMBRANE STRESSES WITH SPECIAL REFERENCE TO THE FINITE ELEMENT TECHNIQUE
J. M. Deb Math and M. Petyt Jul. 1969 114 p refs
(ISVR-TR-22) Avail: CFSTI

Free vibration characteristics of doubly curved rectangular plates are studied. The study though mainly on the application of the finite element technique, includes the Kantorovich modified matrix progression technique also. The later technique is applied for the analysis of free vibrations of uniformly thick second order surfaces without torsion. A doubly curved (with torsion) rectangular finite element is derived and its properties studied. The effects of applied membrane forces are included in the stiffness matrix. The membrane forces may be uni-axial or bi-axial. The membrane forces may be tensile, compressive or entirely shearing in nature or may be combinations of all of them. The element is found to be very convenenitnt to study the degenerate modes of vibrations of doubly curved plates. Author (ESRO)

N70-17561# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
ISOLATION OF THE CONTRIBUTION OF SHIP FOREBODIES TO WAVE RESISTANCE Final Report
John A. Mercier May 1969 36 p refs
(Contract N00014-67-A-0202-0003)
(AD-696652; Rept-1359) Avail: CFSTI CSCL 13/10

The report describes an attempt to isolate the contribution of the forebody of a ship to the wave resistance. Although the net resistance of the forebody of a surface ship model is successfully evaluated, it is found that the component of pressure drag due to the local free-surface disturbance is a large fraction of the total and that, consequently, the resistance associated with propagated waves cannot be separated experimentally. A comparison of theoretically computed and experimentally evaluated wave-making resistance, for a case in which viscous boundary-layer influences do not play an important role, cannot be carried out under this procedure. A brief discussion of other experiments conducted to evaluate forebody drag is included. Mention is made of other recent efforts to correlate experimental pressure measurements with theoretical results. Author (TAB)

N70-17609# Illinois Univ., Urbana. Dept. of Civil Engineering.
EXACT SOLUTIONS OF SOME DYNAMIC PROBLEMS OF INDENTATION AND TRANSIENT LOADINGS OF AN ELASTIC HALF SPACE
J. Carl Thompson and Arthur R. Robinson Sep. 1969 258 p refs *Its* Structural Research Ser. 350
(Contract N00014-67-A-0305-0010)
(AD-697005) Avail: CFSTI CSCL 20/11

In this report the method of self-similar potentials is used to solve certain problems which involve the frictionless indentation of a linearly elastic half space by a rigid die. Solutions which are exact within the limits of the classical theory of elasticity are obtained for the early stages of contact for any problem in which the surface of the die is smooth. For problems in which the die is wedge- or cone-shaped and indents the half space at a constant rate, the solution for the entire process is given. The stress and velocity fields for the wedge and cone problems are considered in detail. This report includes an exposition of the method of self-similar potentials and of the procedure based on this method for solving two- and three-dimensional problems involving transient loads acting at interior or surface points of a homogeneous linearly elastic half space. The asymptotic character of the disturbance near the wave fronts and near the surface wave is determined in detail for both the two- and three-dimensional problems in which the source of the disturbance is an impulse applied normal to the surface of the half space. Author (TAB)

N70-17669# Aeronautical Research Labs., Melbourne (Australia).
THE RELATION BETWEEN COTTRELL-STOKES RATIOS AND STACKING FAULT ENERGIES IN PURE FACE-CENTRED CUBIC METALS
S. McK. Cousland Jun. 1969 16 p refs
(ARL/MET-77) Avail: CFSTI

It is shown that the temperature dependence of the flow stress, expressed as a Cottrell-Stokes ratio, correlates with stacking fault energy for aluminum, nickel, copper, silver, lead, and gold. Since the variation of dislocation configuration with stacking fault energy is not great enough to explain the observed correlation, the variations in width of dissociated dislocations and of energy needed fo constriction are considered to be responsible. Author

N70-17688# National Engineering Lab., Glasgow (Scotland). Ministry of Technology.
A PHOTOELASTIC INVESTIGATION OF THE STRESS DISTRIBUTION IN DISHED-IN ENDS OF SEAMLESS GAS CYLINDERS
J. S. Strannigan and J. Mc Gregor Jan. 1969 17 p refs
(NEL-379) Copyright. Avail: CFSTI

Experimental stress analyses of pressure vessels have been reported in recent years, and there is an increasing interest in the corresponding numerical solutions by computer. However, there appears to be little information on the stress distribution in the dished-in base of a gas cylinder, although cylinders with such bases are frequently used to carry gas under pressure. Photoelastic tests carried out on a gas cylinder with the end convex to pressure, (dished-in) are described. The effects of increasing the thickness of the base and of making the end concave to pressure, (dished-out), were also investigated. Author

N70-17674# Royal Military Coll. of Canada, Kingston (Ontario). Dept. of Civil Engineering.
THE ULTIMATE CAPACITY OF BIAXIALLY LOADED BOX STEEL COLUMNS
P. J. Marshall and J. S. Ellis 15 Oct. 1969 55 p refs Revised
Avail: CFSTI

The intersecting column shape criterion of the plastic theory of steel structures is used to predict theoretically the ultimate capacity of biaxially loaded, pin-ended steel columns having a thin walled square cross-section. Theoretical predictions were made for an axial load which was equal to forty percent of the columns' axial yield load and for a range of end eccentricities associated with symmetrical and non-symmetrical single curvature bending and with symmetrical and non-symmetrical double curvature bending. All these computations for ultimate loads were carried out for columns free from residual stress. The values agree very closely with those previously obtained for the annular cross-section. The predicted ultimate capacities for box section columns are underestimated by failure loads computed on the basis of the attainment of the yield stress at one point in the cross-section. Author

N70-17725 Case Western Reserve Univ., Cleveland, Ohio.
DISCRETE ELEMENT ANALYSIS BY COMBINED METHOD FORMULATION
Martin Don Minich (Ph.D. Thesis) 1968 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-9425

A combined method discrete element approach for predicting the geometrically nonlinear response of rectangular plates is presented. The force and displacement patterns for a rectangular plate element are expressed in terms of products of one-dimensional Hermite interpolation polynomials and undetermined nodal force and displacement parameters. Geometric admissibility of the displacement state of an assemblage of these discrete elements is conveniently satisfied by linking degrees of freedom. The use of the Reissner energy principle facilitates the incorporation of geometric nonlinearity, thus providing the capability to predict finite displacements and accurate force resultants. Numerical solutions are obtained efficiently by the use of the Newton-Raphson technique. Several numerical examples, both linear and nonlinear, which indicate the effectiveness of the analysis, are presented. Dissert. Abstr.

N70-17755 New Mexico Univ., Albuquerque.
MEASUREMENT OF DEFORMATIONS IN A LARGE DISPLACEMENT GRADIENT FIELD
Lowell P. Martin (Ph.D. Thesis) 1968 164 p
Avail: Univ. Microfilms: HC $7.60/Microfilms $3.00 Order No. 69-9259

A summary of the general kinematical theory of finite deformations is presented together with analyses of the specific deformations of simple shear, bending of a block and bending of an initially curved cuboid. The moire fringe equations for large homogeneous deformation are developed. The extension to the nonhomogeneous case is presented and specific analyses are given for the deformations noted above. Theoretical results are verified by the study of geometrically produced moire patterns, and by actual experiments conducted on synthetic rubber specimens. The experiments included the deformations due to simple shear, bending of a block, bending of an initially curved cuboid, and extension of a plane tapered tensile specimen. It is concluded that the moire fringe method is a convenient, versatile and precise method to determine the components of Green's and Cauchy's deformation tensors for large two-dimensional deformations. Dissert. Abstr.

N70-17765 Pennsylvania State Univ., University Park.
A GENERALIZED ENGINEERING DESIGN PROCEDURE
Thomas Glenn Lang (Ph.D. Thesis) 1968 307 p refs
Avail: Univ. Microfilms: HC $13.95/Microfilm $3.95 Order No. 69-5567

A procedure is developed which enables an engineering design problem to be generalized into a set of nondimensional design problems which cover a given design field. The use of the procedure aids in determining the diversity of design form families, the relationships between design form families and sets of design problems, the variations of design form within a family, the relationship between design form and design objective, the scaling of design forms, the classification of design forms and design problems, the nature of research studies which might lead to new information on design form, and areas where invention is needed. Examples are presented to illustrate the use of the design procedure: (a)circular tubes under external pressure, (b) columns under compressive loads, (c) submerged vehicles, (d) airplane wings and fully-wetted hydrofoils, and (e) cavitating and noncavitating hydrofoil cross sections. Dissert. Abstr.

N70-17878# Ohio State Univ. Research Foundation, Columbus.
ANALYSIS OF SHALLOW SHELLS BY THE METHOD OF POINT MATCHING Final Technical Report, 1 Dec. 1966 - 31 Mar. 1969
Arthur W. Leissa and Adel S. Kadi Aug. 1969 230 p refs
(Contract F33615-67-C-1177)
(AD-696199; AFFDL-TR-69-71; FTR-7) Avail: CFSTI CSCL 20/11

The report summarizes a study aimed at extending the applicability of the method of point matching to problems of statically loaded shallow shells, and deriving a set of shell equations for arbitrary curvature including the effects of orthotropy and thermal loading. The accuracy of the method is investigated by solving a problem for which an exact solution exists -- the uniformly loaded, shallow spherical shell supported along a square boundary by means of shear diaphragms. Solutions to the governing system of differential equations are derived in polar coordinates in terms of Kelvin-Bessel functions and then expressed in a general form for boundaries having arbitrary normal and tangential directions. Further experiences with the method are demonstrated on problems of shallow spherical shells having regular polygonal and elliptical boundaries. For contrast, clamped and shear diaphragm edge conditions are studied. General solutions for circular cylindrical shallow shells, where the effects of rectangular orthotropy and thermal gradients are retained, are obtained by means of the auxiliary function approach. Author (TAB)

N70-17890 Wisconsin Univ., Madison.
BUCKLING OF COMPOSITE CYLINDRICAL SHELLS UNDER AXIAL AND RADIAL LOADING
Ming Min Lei (Ph.D. Thesis) 1968 37 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-16000

A theoretical analysis of the buckling of a multi-layered thin orthotropic composite circular cylindrical shell of finite length subjected to (1)uniform axial compression (2) axial compression and radial pressure is presented. At each end of the shell, four boundary conditions are completely satisfied. Four combinations of boundary conditions for simply supported shell and four combinations of boundary conditions for clamped shell are treated. Boundary conditions are reduced to the vanishing of a fourth order determinant. Buckling loads for boron-epoxy composite shells are determined and the results are shown in a series of diagrams. The effect of boundary conditions on the buckling load for various geometrical dimensions of composite cylinders is investigated. Details of the boundary conditions have strong influence on the buckling load of the shell. Dissert. Abstr.

N70-17894# Central Mechanical Engineering Research Inst., Durgapur (India).
A GENERALIZED ANALYSIS OF INTERCONNECTED BEAM SYSTEM BY ENERGY METHOD
P. D. Das and M. M. Basole (Regional Engineering Coll.) May 1969 23 p refs
(CMERI-B7) Avail: CFSTI

An analysis of the interconnected beam system for concentrated loads with reference to bridge structure by energy method is presented. By minimizing the total energy of the beam system, sets of equations are obtained and they are presented in the most generalized form. A computer program for the use of IBM 1620 is made which takes care of the variables like the number of main and cross beams, properties of the section and different load positions etc. Author

N70-17895# British Iron and Steel Research Association, London (England). Metallurgy Div.
INFLUENCE OF INERTIAL LOAD IN INSTRUMENTED IMPACT TESTS
S. Venzi, A. H. Priest, and M. J. May [1964] 27 p refs *Its* BISRA Open Report
(MG/C/85/68) Avail: CFSTI

The effect of inertial loading in instrumented impact tests has been studied and it is shown that during such tests large errors can be made in calculating the bending stress of a specimen at fracture if inertial loading is not taken into account. By instrumenting the tup, anvil and specimen it is shown that in the period over which internal effects occur, there is no simple relationship between the load measured on the tup, anvil and specimen. To assist in interpretation and evaluation of impact load-time curves, a model has been used which relates the spring constants and masses of the tup and anvil of the test machine and specimen to the frequency phase and relative amplitude of the oscillations occurring in the impact test. Author

N70-17951*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL STUDY OF COOLED TURBINE BLADES CONSIDERING COMBINED STEADY-STATE AND TRANSIENT CONDITIONS
Albert Kaufman Washington Jan. 1970 30 p refs
(NASA-TM-X-1951; E-5242) Avail: CFSTI CSCL 20K

A stress analysis considering both creep and fatigue damage was made for three turbine blade cooling configurations for hypothetical advanced air breathing engine missions each consisting of a fast acceleration, a 2-hour cruise at Mach 3 and 75,000 feet (22.86 km), and a fast deceleration. The best design was a film-convection cooled configuration followed by a multiple small hole design. A liquid metal cooled blade showed the poorest life largely because of severe fatigue damage. Author

N70-17960# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLASTIC BEHAVIOR OF SHALLOW SPHERICAL SHELLS UNDER LARGE BENDS
M. Duszek 7 May 1969 18 p refs Transl. into ENGLISH from Bull. Polon. Sci. Ser. Sci. Tech. (Warsaw), v. 15, no. 9, 1967 p 767–777
(AD-696547; FTD-HT-23-1501-68) Avail: CFSTI CSCL 13/13

It is known that the real carrying capacity of shells may exceed considerably the value of theoretically calculated maximum loads because such calculations do not take into account the changes in geometry during the deformation process as well as the contribution of membrane forces. Consequently, the carrying capacity of shallow, spherical shells subjected to a uniform internal pressure has been studied theoretically assuming a rigid/plastic shell without reinforcement, which obeys the Trescas plasticity condition, and the associated yield law. The deflections are not greater than the thickness of the shell, and initially there exists a momentless state at the center of the shell. An increasing load brings about a rapid widening of the momentless zone and for a bending of the order of shell thickness all moments are concentrated within a narrow region in the vicinity of the supports. The corresponding load differs by only about one percent from that corresponding to the membrane momentless solution. Author (TAB)

N70-18009 Colorado State Univ., Fort Collins.
STRESSES NEAR A CIRCULAR CRACK IN A HALF SPACE
Mir Jafar Alavi (Ph.D. Thesis) 1968 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-5462

Solutions are presented for a circular crack embedded in a semi-infinite solid and for a part circular crack in the surface of a semi-infinite solid. The stresses in the neighborhood of the crack were found by a superposition and iteration technique. Recurrence relationships and series solutions for some integrals involving Bessel functions were derived to facilitate the computations. A computer program was written to compute the stresses and stress intensity factor for two types of normal loading and for several crack geometries. Dissert. Abstr.

N70-18011# Cambridge Univ. (England). Dept. of Engineering.
HIGH-STRAIN, LOW-ENDURANCE FATIGUE: A REVIEW
K. J. Miller 1969 121 p refs
(CUED/C-Mat./TR1) Avail: CFSTI

Reviewed are the basic aspects of deformation and fatigue studies with emphasis on the most important parameter of straining rate. It is shown that prior cycling action can modify both static and conventional creep test behavior as well as the structure of the material. Since the shape of specimens is as important in high strain fatigue studies as it is in static tests, strain concentrating specimens such as notched bars and hour glass shaped specimens should not be used to determine material behavior especially at temperatures and strains that are associated with near perfect placicity. G.G.

N70-18026# Cambridge Univ. (England). Dept. of Engineering.
LIMIT ANALYSIS OF SPHERICAL SHELLS BY DYNAMIC PROGRAMMING
R. Barras 1969 59 p refs
(CUED/C-STRUCT/TR1) Avail: CFSTI

A dynamic programming method in the calculus of variations is used to determine the collapse loads of shell structures when applying the upper bound theorem of plasticity. The upper bound that defines a load by equating the internal work dissipated to the external work done by the load, determines the plastic strain rate in the structure and the rate at which energy is dissipated plastically. If this upper bound is minimized over a complete set of velocity fields, the exact collapse is found. G.G.

N70-18033# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON EQUILIBRIUM MODES OF A RECTANGULAR PLATE IN A GAS FLOW
N. V. Valishvili et al 1969 6 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 33, no. 5, 1969 p 928–932
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The equilibrium modes of an elongated rectangular plate in a gas flow are investigated with the solution of nonlinear boundary value problems. The expressions for the bending moment and the angle of rotation of the normal to the plate surface are developed. Examined were: (1) plate with hinge-fixed edges, (2) plate with hinge-fixed left and rigidly clamped right edges, (3) plate with rigidly clamped left and hinge-fixed right edges, and plate with rigidly fixed edges. All these were solved by using the same numerical algorithm. It is concluded that the problem cannot be carried out successfully to completion by finite differences because of divergence of the computation. F.O.S.

N70-18048 Carnegie-Mellon Univ., Pittsburgh, Pa.
LARGE DEFLECTION THEORY FOR PLATES SUBJECTED TO DYNAMIC EDGE LOADING
Richard Lee Van Tassel (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-6589

In the experimental program, sixteen plates were subjected to in-plane edge loading while the plate was supported in a V-groove test apparatus. Both static and transient loading conditions were investigated. The theoretical behavior of thin plates subjected to transient in-plane edge loading was investigated using large deflection plate theory. The solution of the resulting nonlinear-differential equation was obtained by using a computer language which was applicable to the solution of integro-differential equations. The results of the theoretical investigation are presented in the form of impact factor curves for maximum transient deflection and edge strain. A comparison between the experimental results and theoretical results are reported. Dissert. Abstr.

N70-18067# Picatinny Arsenal, Dover, N.J.
CIRCULAR BEAMS WITH OUT-OF-PLANE LOADING
William Griffel Oct. 1969 107 p refs
(AD-696416; PA-TR-3972) Avail: CFSTI CSCL 13/13

The purpose of this report is to make possible simplified calculations of stresses and deflection at any point in a curved beam of uniform cross section. An out-of-plane load, which is a load normal to the plane of curvature, is assumed. 17 different loading and support conditions are considered. The results apply to 4 different cross sectional shapes. A Poissons ratio of 0.3, usually used for steel and aluminum, is assumed. Author (TAB)

N70-18074 Catholic Univ. of America, Washington, D.C.
MOIRE ANALYSIS OF MOTION
Vincent Joseph Parks (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-9082

The class geometric relations of position, motion, and deformation, including large motions and large deformations, are reviewed. Moire, defined as the interference of two line gratings producing a fringe pattern, is presented and the relation of fringes to the grating lines is given. With these geometric and moire descriptions, the exact relation between moire fringes and motion and deformation in a plane is developed. Two types of moire patterns are described, one related to displacements, and a second related to the partial derivatives of the components of displacements. Three problems are solved: (1) large strains in a thick ring subjected to diametral compression, (2)partial derivatives of components of displacement in a disk subjected to diametral compression and (3) large strains in a plate with a hole and a notch. Each of the three problems illustrates several features of the theoretical and experimental developments. Dissert. Abstr.

N70-18090 South Carolina Univ., Columbia.
A STUDY OF THE NATURAL VIBRATIONS OF A SET OF N ELASTICALLY CONNECTED CONCENTRIC CIRCULAR RINGS
Kenneth Alva Stead (Ph.D. Thesis) 1968 92 p refs
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-5813

This study considers the problem of the natural in-plane inextensional flexural vibrations of a set of elastically connected elastic rings all lying in the same plane. A short history of beam bending theory is given, touching salient studies from James Bernoulli to the present. Some theoretical and experimental studies of the vibrations of thin rings, elastically supported rings, and systems of elastically connected straight beams are discussed in detail. The differential equation governing the natural vibrations of a set of n rings is developed and the form of the solution is shown. The loop rule equation is utilized to form a systematic way of writing the frequency equation. The solution for a double ring system free in space is worked out in detail. Theoretical frequencies and mode shapes are compared with those obtained by experiment on a double ring system. Of particular interest are the steady-state vibrations found in the experiment in which there are different numbers of nodes on the two rings. It is asserted that this phenomenon results from the combination of two different normal modes. A rule of mode combination is proposed, by means of which the observed patterns were matched. Also of interest was the apparent combination of two different modes at more than one frequency. These nodal patterns were also matched by the proposed rule. Dissert. Abstr.

N70-18167# Lockheed Missiles and Space Co., Palo Alto, Calif.
SURVEY OF INVESTIGATIONS ON THE STABILITY OF STRUCTURES UNDER PULSE LOADING
V. L. Agamirov 1969 25 p refs Transl. into ENGLISH from the book "Raschet Prostranstvennykh Konstruktsii" USSR, Stroizdat., 1969 p 186–200
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A review is presented of journal articles on the dynamic stability of elastic systems. Problems in which the behavior of an elastic system loaded by a stress applied in the form of a pulse and also subject to an intrinsically shock loading are investigated. Buckling of rods, buckling of plates and cylindrical panels, and closed cylindrical shells are discussed. N.E.H.

N70-18169# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
DETERMINING THE FUNDAMENTAL OSCILLATING FREQUENCIES FOR COMPLEXLY SHAPED SHELLS WITH FREE BOUNDARIES [DETERMINATION DES FREQUENCES PROPRES DES OSCILLATIONS DES COQUES DE FORME COMPLEXE A BORDS LIBRES]
G. M. Salnikov and A. G. Zenukov [1969] 14 p refs In FRENCH and RUSSIAN *Its* Trans. of Higher Educational Inst. No. 4
(LRBA-69-0962) Avail: CFSTI

An attempt is made to obtain simple empirical relationships by which the fundamental frequencies of complexly shaped shells can be computed. The shells studied were cylindrically round, elliptical, with turbine shape, and also shells conical along the entire length, which have a circle and an ellipse in the base. It is shown that the oscillations of the circular and noncircular shells did not differ in quality. Using the notion of a dummy radius, the fundamental frequency of cylindrical and conical circular and noncircular shells can be determined by a more precise expression of the Relei formula, with a precision sufficient for engineering calculations. Transl. by H.W.

N70-18203# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN APPROXIMATE METHODS OF DESIGNING MINIMUM-WEIGHT STATICALLY INDETERMINATE SYSTEMS
N. Kh. Khasanshin 12 Mar. 1969 19 p refs Transl. into ENGLISH from Aviats. Inst., Tr. (Kazan), no. 91, 1966 p 126–138
(AD-696542; FTD-HT-23-1208-68) Avail: CFSTI CSCL 20/11

The work investigates the approximate method of designing statically indeterminable minimum-weight systems by using the apparatus of specular function theory. The specular functions used in this work transform into simple nonmodular functions the law of using them is ascertained and the minimum values of these functions are sought by analytical and graphical methods. The successive approximation method is used in multivariable functions, and the computation is conducted within the confines of Hooke's law with regard only to bending moments stability questions omitted. TAB

N70-18254# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF THE BOUNDARY CONDITIONS ON THE STABILITY OF A CYLINDRICAL SHELL SUBJECTED TO TORSION AND TRANSVERSE PRESSURE
V. A. Ziuzin 1969 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Tverdogo Tela (USSR), no. 5, 1969 p 82–87
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of stability of a circular cylindrical shell is examined from the viewpoint of semimembrane theory. The pure torsion case is examined in detail. By introducing a new loading parameter, an effective solution is successfully obtained which admits of considerable simplification within the practical range of variation of the geometric shell parameters. Simple computational formulas are obtained to determine the critical loadings of pure torsion taking into account the conditions for fixing the endplate sections. The cases of rigid, hinge-supported, and elastically supported shell endfaces are examined. In the case of the combined effect of torsion and internal pressure, the solutions obtained agree, in practice, with known results of investigations made on the basis of shallow shell theory. Author

N70-18270# Michigan State Univ., East Lansing. Div. of Engineering Research.
WAVE PROPAGATION AND MATERIAL RESPONSE UNDER DYNAMIC LOADING Final Report
L. E. Malvern 19 Aug. 1969 16 p refs
(Grant NSF G-1396-X)
Avail: Issuing Activity

Experimental investigations of the wave propagation in prestrained polyethylene rods, harmonic dispersion analysis of incremental waves in uniaxially prestressed plastic and viscoelastic bars, wave propagation with combined stresses, and incremental longitudinal plastic waves in dynamically prestressed aluminum bars are described. Results include: (1) There was demonstrated validity of the assumption that the small incremental wave can be handled by linear analysis even when the prestrain is into the nonlinear range of the polyethylene, and of the measurement techniques. (2) Preliminary findings on the leading edge wave speeds for incremental waves may support harmonic analysis conclusions and the hypothesis that lateral inertia and shear effects cause their differences from c sub p instead of being caused by rate effects in the constitutive equation. (3) Foil strain gage measurements show promise in picking up slope changes in the initial strain wave of leading edge speeds. (4) The numerical solution for a nonsimple wave in a half space when plotting level lines of axial and shear stress and velocity is resolved in straight lines even though the solution is not a simple wave. M.H.E.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-16916 National Lending Library for Science and Technology, Boston Spa (England).
THE PROBLEM OF NON-SPARKING TOOLS [DIE PROBLEMATIK DER NICHTFUNKENSCHLAGENDEN WERKZEUGE]
J. Weingaertner 28 Jul. 1969 11 p refs Transl. into ENGLISH from Sichere Arb. (Germany), v. 21, no. 2, 1968 p 22–25
(NLL-SMRE-Trans-5766-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Safety factors related to spark-resistant tools are discussed in terms of frictional and impact spark formation, and sparks for nonflammable materials and light metals. Spark ignition test results are given. Alloyed steel tools, such as chrome vanadium, are recommended for use in working zones near explosive mixtures. J.A.M.

N70-16946 National Lending Library for Science and Technology, Boston Spa (England).
THE AERODYNAMICS OF SWIRLING FLOWS
W. Leuckel 19 Sep. 1969 26 p refs Transl. into ENGLISH from Rev. Gen. Thermique (Paris), v. 7, Dec. 1968 p 1367–1383
(NLL-CE-Trans-5176-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

Diffusion of a turbulent jet in a confined medium is discussed in terms of swirl intensity and flow geometry, with emphasis on the stability of the internal circulation zone. Cones adapted for different divergent burning nozzles were compared to determine their ability to stabilize the internal circulation zone. Cones with angles equal to or greater than the angle of the nozzle were highly effective stabilizers. The efficiency of swirl generation was defined by comparing the flux of kinetic energy through the throat of the burner with the static pressure drop between the air inlets and the throat. J.M.C.

N70-17003# Naval Research Lab., Washington, D.C.
US NAVY FIRE RESEARCH BULLETIN, VOLUME 1, NO. 1
R. L. Tuve, ed. Sep. 1969 16 p refs
(AD-696939) Avail: CFSTI CSCL13/12

From the literature that bears on fire protection, an attempt is made to call attention to selected publications and articles dealing with basic research, fire technology, and fire suppression operations, by abstracts and editorial comments. Author (TAB)

N70-17091# California Univ., Los Angeles. Dept. of Physics.
THIRD SOUND IN UNSATURATED FILMS OF SUPERFLUID HELIUM
I. Rudnick and James C. Fraser Oct. 1969 139 p refs
(Contract N00014-67-A-0111)
(AD-696647; TR-30) Avail: CFSTI CSCL 20/13

The velocity of third sound in unsaturated films of superfluid helium has been measured at several temperatures between 1.12K and 2.05K. Helium films from 4 to over 100 atomic layers were adsorbed on glass substrates. The third sound waves were generated thermally. They were detected by sensing the very small temperature oscillations which accompany the hydrodynamic wave. The velocity was measured by the time of flight of sine wave pulses whose frequency ranged from 500 Hz to 5 KHz. The velocity was found to be less than that predicted by Atkins hydrodynamic theory of third sound in saturated helium films which is based on the thermodynamic properties of the bulk liquid. Atkins equations have been modified to take into account a variation of the thermodynamic properties of the film with thickness. An analysis of the velocity data has yielded the average superfluid density as a function of film thickness. Reduction of the superfluid fraction has been compared to the Ginzburg-Pitaevskii theory of superfluidity and a quantity which can yield values of the characteristic healing length of the theory has been determined from the data. The presence of a solid or normal fluid layer has been taken into account. Author (TAB)

N70-17111*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED METHOD FOR CALCULATING THERMAL CONDUCTANCE OF ROUGH, NOMINALLY FLAT SURFACES IN HIGH VACUUM
Daniel J. Mc Kinzie, Jr. Washington Jan. 1970 44 p refs
(NASA-TN-D-5627; E-5293) Avail: CFSTI CSCL 20M

A simplified approximate method for calculating the coefficient of thermal contact conductance has been derived. The method applies to the case of rough, nominally flat, outgassed surfaces in contact and under load in a high vacuum environment. The asperities of the surfaces are assumed to be undergoing plastic deformation. The method does not require the use of a computer program, but it does require the use of a surface analyzer and hardness tester. The method is used to calculate the interface conductance of two tungsten cylinders tested at approximately 0.000001 torr and is in good agreement with experimental results. Author

N70-17163# Royal Aircraft Establishment, Farnborough (England).
HEATPIPES AND VAPOUR CHAMBERS FOR SATELLITE THERMAL BALANCE
C. J. Savage Jun. 1969 39 p refs
(RAE-TR-69125) Copyright. Avail: CFSTI

Heat pipes and vapor chambers, employing the principles of vapor heat transport, may be constructed with thermal conductances far higher than a solid metal structure with similar dimensions. The operation of these devices is described, and quantitative estimates are obtained of the performance to be expected from them. Ways in which they may be used to assist satellite thermal control are discussed. Author (ESRO)

N70-17271# European Atomic Energy Community, Luxembourg. Commissariat a l'Energie Atomique, Saclay (France).
HEAT TRANSFER IN SMOOTH TUBES, BETWEEN PARALLEL PLATES, ALONG A SEMI-INFINITE PLATE, IN

ANNULAR SPACES AND ALONG TUBE BUNDLES FOR EXPONENTIAL DISTRIBUTION OF HEAT FLUX IN FORCED, LAMINAR OR TURBULENT FLOW [DER WAERMEUEBERGANG IN GLATTEN ROHREN, WISCHEN PARALLELEN PLATTEN, LAENGS DER EBENEN PLATTE, IN RINGSPALTEN UND LAENGS ROHRBUENDELN BEI EXPONENTIELLER WAERMEFLUSSVERTEILUNG IN ERZWUNGENER LAMINARER ODER TURBULENTER STROEMUNG]

H. Graeber 1969 287 p refs In GERMAN; ENGLISH summary Prepared by CEA *Its* Association No. 006-61-1 RAAF (EUR-4381.d) Avail: CFSTI

By introducing an additional parameter the processes known hitherto for calculating heat transfer are extended to the heat flux distributions following an exponential law which give a heat transfer coefficient independent of position for laminar and turbulent flow with a linear pressure drop. For laminar flow along a semi-infinite plate, the heat flux distribution in accordance with the leads to the Nusselt number, regardless of the position. Nu is then determined by the thickness of the thermal boundary layer. With an approximation process it is possible to calculate the thickness of this thermal boundary layer and then the Nusselt number, defined by the distance x from the front edge of the plate. For the annular space, the equations for explicit calculation of the temperature field will be given as well as the Nusselt number in laminar fow and constant heat flux, the heat transfer taking place on one wall or both. In turbulent flow the laws of distribution of eddy diffusivity for momentum in a tube, established by H. Reichardt, adapted for the annular space and the tube bundle give the velocity field and the coefficient of friction and thus permit solution of the heat transfer equations. The results of the numerical calculation are given in the tables and diagrams for an extended range of the various parameters and are compared with the experimental results. Author

N70-17288*# Pennsylvania State Univ., University Park. Mechanical Engineering Dept.

BIPROPELLANT DROPLET BURNING RATES AND LIFETIMES IN A COMBUSTION GAS ENVIRONMENT

G. M. Faeth and R. S. Lazar 1 Dec. 1969 81 p refs (Grant NGR-39-009-077) (NASA-CR-72622) Avail: CFSTI CSCL 21B

Measurements of droplet heat-up and steady burning were made at atmospheric pressure with a flat flame burner apparatus. Various alcohols and paraffin hydrocarbons were tested at ambient temperatures of 1660 to 2530 K and ambient oxygen concentrations in the range 0 to 38%. Existing diffusion flame theories of droplet combustion gave an adequate prediction of the measured influence of ambient oxygen concentration and temperature, but showed progressive failure for the heavier hydrocarbons. Flame luminosity was observed very early in the heat-up period. The steady burning theory was extended to include the heat-up period and theoretical and experimental comparisons were made over the entire droplet lifetime with results roughly the same as the steady burning results. Author

N70-17366*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.

ANALYSIS BY CONFORMAL MAPPING OF STEADY FROZEN-LAYER CONFIGURATION INSIDE COLD RECTANGULAR CHANNELS CONTAINING WARM FLOWING LIQUIDS Technical Note

Robert Siegel and Joseph M. Savino Washington Jan. 1970 38 p refs (NASA-TN-D-5639; E-5104) Avail: CFSTI CSCL 20M

A channel containing warm flowing liquid is cooled so that its walls are below the liquid freezing temperature. A frozen region forms in a shape such that the energy convected to the frozen interface by the warm liquid can be conducted through the frozen material to the walls. The shape of the frozen interface is determined by representing the frozen region by a rectangle in a potential plane, and this rectangle is mapped conformally into the physical plane. Either of two frozen regions can be obtained mathematically for a given value of the governing cooling parameter in a certain range, but one is physically unstable. For larger cooling than in this range, the channel will freeze completely. Author

N70-17454# Central Electricity Generating Board, London (England). Research and Development Dept.

A SHORT STUDY OF CAPILLARY ACTION IN BOILING WATER HEAT TRANSFER THROUGH POROUS MEDIA

A. A. Stratton and W. N. Walker Jul. 1969 17 p (RD/B/N-1358) Avail: CFSTI

Experiments were carried out to test the proposal that a boiling process involving capillary action occurs when porous layers are built up between a heat transfer surface and its liquid coolant. A theoretical model was also set up and compared with the experimental results. Tests with real porous media were inconclusive owing to poor thermal contacts. Experiments with a single capillary indicated that boiling within pores was explosive owing to restricted bubble expansion, and was only well predicted by the theory when the resulting meniscus movement was small. This condition is expected to hold in porous media, and, by application of the theory to these, it was found that this process may provide an efficient heat transfer mode. Author (NSA)

N70-17462# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

MEASUREMENT OF THE LOCAL VOID FRACTION AT HIGH PRESSURES IN A HEATING CHANNEL [MESURE DE TAUX DE VIDE A HAUTE PRESSION DANS UN CANAL CHAUFFANT]

Robert Martin (Ph.D. Thesis - Grenoble Univ., 29 Sep. 1967) Sep. 1969 185 p refs In FRENCH; ENGLISH summary (CEA-R-3781) Avail: CFSTI

Void fraction measurements were made in two phase flow boiling systems at high pressures in a uniformly heated, rectangular channel with a high aspect ratio. The local void fraction values were calculated from measurements of the absorption of a thin collimated X-ray beam (2 mm $\times$ 0.05 mm). The mean void fraction in a horizontal section results from integration of the local values across the section. At a fixed measuring station the quality and void fraction were varied by changing the heat flux, flow rate and pressure systematically. Two channels were used differing in length and thickness. The void fraction measurements are among the first obtained at such high pressure. In the experimental region under consideration the measurements are systematic and numerous enough to allow accurate interpolations. Tests were performed under local boiling conditions with the mean temperature of the fluid below the saturation temperature. These results were compared to the predictions of certain models presented in the literature and simple empirical formulae were developed to fit the experimental results. Author (ESRO)

N70-17608*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.

THERMOMETRIC DETERMINATION OF OXIDANT-FUEL DISTRIBUTION WITHIN A ROCKET COMBUSTOR

Marshall C. Burrows Washington, D.C. Jan. 1970 17 p refs (NASA-TN-D-5626; E-5199) Avail: CFSTI CSCL 20M

Tungsten-rhenium alloy thermocouples were used to determine the distribution of hydrazine - nitrogen tetroxide products within a combustion chamber. Temperatures indicated by bare-wire thermocouples were a single-valued function of mixture ratio in part of the O/F range. Within this range, local composition could be estimated. The thermocouples also were used to determine changes in composition caused by induced mixing of products. Author

N70-17617*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.

SHOCK-TUBE THERMOCHEMISTRY TABLES FOR

HIGH-TEMPERATURE GASES: HELIUM, NEON, AND ARGON, VOLUME 3 Technical Report
W. A. Menard and T. E. Horton 1 Jan. 1970 145 p refs
(Contract NAS7-100)
(NASA-CR-107849; JPL-TR-32-1408) Avail: CFSTI CSCL 20M

Equilibrium thermodynamic properties and species concentrations for helium, neon, and argon are tabulated for moving, standing, and reflected shock waves. Initial pressures range from 0.05 to 50.0 torr, and temperatures from 2000 to over 100,000 K. Author

N70-17634*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BOILING WATER COOLING OF A HYPOTHETICAL LARGE SOLID ROCKET NOZZLE LINED WITH A POROUS WALL OR A MELTING INSULATING COATING
William A. Olsen, Jr. Washington Jan. 1970 38 p refs
(NASA-TM-X-1952) Avail: CFSTI CSCL 20M

A preliminary analytical investigation was made of two thermal protection methods that use a boiling liquid to cool a large solid rocket nozzle. One method involves an insulation coating, where cooling is accomplished by boiling water in tubes behind the coating. The other method involves lining the nozzle with a porous wall through which water flows and evaporates within the pores or at the hot-gas porous wall surface. The first method is sensitive to boiling burnout and tube overheating problems, while the second method is not. The overall coolant flows required in order to have adequate thermal protection from either method are approximately comparable. Author

N70-17657# Institute of Nuclear Research, Warsaw (Poland).
SOME APPLICATIONS OF RESISTANCE ANALOG COMPUTER TO THE SOLVING OF HEAT CONDUCTION PROBLEMS
A. Strupczewski 1968 39 p refs
(INR-976) Avail: CFSTI

Several solutions of steady and unsteady state heat conduction problems reached on resistance analog computers illustrating various possibilities of their use are described. A comparison of time, precision, and costs of solutions is given for resistance analog computers and digital computers. Author

N70-17718# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
HEAT TRANSFER MEASUREMENTS WITH SUPERHEATED STEAM IN TUBES AND CONCENTRIC ANNULAR CHANNELS [WAERMEUEBERGANGSMESSUNGEN MIT UEBERHITZTEM WASSERDAMPF IM ROHR UND KONZENTRISCHEN RINGKANAL]
A. Kuetuekcueoglu Jun. 1969 64 p In GERMAN
(FIR-155) Avail: AEC Depository Libraries

The effects of the Prandtl number, the Reynolds number, the temperature change at the boundary layer, and the L/d sub h ratio were investigated on the basis of heat transfer measurements with superheated steam in tubes and concentric rings. The results were compared with existing data. The measurements were carried out in the pressure range from 19 to 33 bar, steam temperature range from 241 to 470 C, Reynolds number range from 90,000 to 300,000 and Prandtl number from 0.9 to 1.2. The relatively large L/d sub h effect can be explained by the thermal formation of the flow. In ring channels about 10% lower heat transfer numbers were obtained under comparable conditions than in tubes. This difference was attributed for the most part to the different temperature and velocity distributions in the tube and in the one sided heated rings. Under certain simplifying assumptions, the Hall measurement results in tubes were transformed so that the heat flow density and temperature patterns in the internal partial channel up to the zero shearing stress line were similar to that in tubes or in a partial channel of a tube bundle. NSA

N70-17788 Georgia Inst. of Tech., Atlanta.
HEAT AND MASS TRANSFER IN SEMI-POROUS CHANNELS
William Moore Massey, Jr. (Ph.D. Thesis) 1969 189 p refs
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-4513

An analytical investigation is made to determine the heat and mass transfer mechanisms of a binary mixture of gases flowing in a parallel plate channel where mass injection occurs at one wall. The walls of this semi-porous channel are at different temperatures. Applications of this investigation to freeze-drying of foods are presented. The analysis uses the integral continuity, momentum, energy, and diffusion equations to establish the velocity and pressure distributions, the temperature profiles, and the mass concentration profiles in the channel. The flow in the channel is assumed to be steady, laminar, and incompressible. Closed form solutions are obtained for the velocity, temperature, and concentration distributions. The accuracy of the approximate hydrodynamic solution is established by comparison with existing solutions of the differential equations. Dissert. Abstr.

N70-17871# Technische Hochschule Stuttgart (West Germany). Arbeitsgemeinschaft Fuer Raketentechnik und Raumfahrt.
HEAT TRANSFER MEASUREMENTS ON ROCKET PROPULSION SYSTEMS. PART 1: DESIGN OF A PROPULSION SYSTEM FOR MEASURING LOCAL HEAT TRANSFER ON ROCKET PROPULSION SYSTEMS [WAERMEUEBERGANGSMESSUNGEN AN RAKETENTRIEBWERKEN TEIL 1: ENTWURF EINES TRIEBWERKS ZUER MESSUNG DES OERTLICHEN WAERMEUEBERGANGS AN RAKETEN TRIEBWERKEN]
Eugen Schaefer Dec. 1968 60 p refs In GERMAN
(AGRR-TB-17-Pt-1) Avail: CFSTI

Described is the construction of an experimental propulsion system that will be used to measure local heat transfer at chamber pressures of 20 to 50 bar. The interior chamber wall of a water cooled combustion chamber is subdivided for this purpose into single segments. Radial heat flux from strictly local heat transfer is obtained if the segments are sufficiently thin and axial heat conductance in the chamber wall is stopped by isolation layers between the segments. Two wall temperature measurements during stationary phases make it possible to determine the temperature field at various radii and thus the radial heat flux and heat transfer. Effects of the injection system on heat transfer are eliminated by using different injection systems for combustion experiments. Transl. by G.G.

N70-17960*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOCAPILLARY INDUCED BREAKDOWN OF A FALLING LIQUID FILM
Frederick F. Simon and Yih-Yun-Hsu Washington Jan. 1970 37 p refs
(NASA-TN-D-5624; E-4520) Avail: CFSTI CSCL 20M

A study was made of the breakdown due to heating of a falling liquid film. Heating is believed to create thermocapillary effects which cause the film breakdown. Visual observation of the formation of a critical film thickness prior to film breakdown was used to formulate an analytical equation for correlating the experimental data. Author

N70-17972 Auburn Univ., Ala.
THE PREDICTION OF THE THERMAL CONDUCTIVITY OF HETEROGENEOUS MIXTURES
Shui-Chih Cheng (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-5506

A theoretical technique for predicting the thermal conductivity of two-phase and three-phase solid heterogeneous mixtures was developed. The method is an extension of Tsao's model for predicting the thermal conductivity of two-phase solid heterogeneous

mixtures. Tsao's technique requires experimental data to evaluate the constants of the probabilistically-determined distribution of the discontinuous phase in the continuous phase. These data are required before a value of thermal conductivity can be calculated. The technique described relies on the assumption of a parabolic distribution of the discontinuous phase and an analytical development to predict the distribution constants. These constants plus values of the thermal conductivity of the constitutents are all that are needed to predict the thermal conductivity of two-phase solid mixtures. This technique is extended for three-phase and multiphase solid mixtures, and in addition is applied to suspensions, emulsions and porous materials. Dissert. Abstr.

N70-17975# European Atomic Energy Community, Brussels (Belgium).
EXPERIMENTAL STUDY ON HEAT TRANSFER IN PARALLEL-FLOW TUBE BUNDLES AT CONSTANT HEAT FLUX FOR MEDIUM PRANDTL NUMBERS [EXPERIMENTELLE UNTERSUCHUNG DES WAERMEUEBERGANGS IN PARALLEL DURCHSTROEMTEN ROHRBUENDELN BEI KONSTANTER WAERMESTRONDICHTE IM BEREICH MITTLERER PRANDTL-ZAHLEN]
M. Rieger Oct. 1969 155 p refs In GERMAN; ENGLISH summary Prepared in cooperation with CEA, Saclay, France
(EUR-4299-d) Avail: CFSTI

The heat transfer parameters were determined experimentally in electrically heated tube bundles for turbulent flow parallel to the axis. The tubes were arranged in a pattern of equilateral triangles. The ratios of the distance between the axes of the tubes to their external diameter were 1.60 and 1.25 in the two test sections studied. The bundles contained 31 heated tubes of the same diameter and were surrounded in each case by a cylindrical shell which was also equipped with electric heating. The heat flux at the surface of the tubes was about 10 W/ square cm. The wall temperatures in the bundle were measured directly with thermocouples which were embedded in the surfaces. The points of temperature measurement were chosen at numerous positions in the lateral cross-section and permitted measurement of the mean and local heat transfer coefficients in the tube bundle. The experiments were carried out with distilled water and with a mixture of 60 % ethylene glycol and 40% water. The values obtained for the Prandtl numbers in this way fell within the range from 2.3 to 18. The Reynolds numbers were varied between 10,000 and 100,000. The relation between the mean heat transfer coefficients and the friction factor in the tube bundles was found from experiments. For certain local Nusselt numbers deviations of up to 20% with respect to the relations given were observed. Author

N70-18025 Houston Univ., Tex.
A STUDY OF VERTICAL TURBULENT FILM BOILING AND INTERFACIAL EFFECTS
Glenn Elmer Coury (Ph.D. Thesis) 1968 370 p
Avail: Univ. Microfilms: HC $16.65/Microfilm $4.75 Order No. 69-5364

It was shown that this complex process could be modeled mathematically by a two step analysis. First, a quasi-steady state model led to predictions of the heat transfer rates at any instant based on the velocity and temperature profiles that exist at that instant. The results of the quasi-steady state solution were then applied to the unsteady state condition, which is characterized by interfacial waves and a continually changing vapor film thickness, to determine the heat transfer rates at each instant of time. These results were averaged over time and space to give local and overall heat transfer rates expressed in dimensionless form. The analysis considers the effects of both the interfacial velocity and the interfacial roughness. The theory correlated data taken from systems where large waves were encountered and from relatively wave-free systems. Experimental measurements were made of the instantaneous local surface heat flux by means of a low mass, surface thermocouple and a heat meter. Interfacial waves were found to be so large under some conditions as to cause occasional liquid-solid contact. Spectral analysis showed that the surface heat flux variations were random and caused by interfacial activity, and that the spectrum of these variations covered a broad frequency range from about 10 to 100 cps. Dissert. Abstr.

N70-18053 Oklahoma Univ., Norman.
A STUDY OF ELECTROFLUIDMECHANICAL INTERACTIONS IN BOILING HEAT TRANSFER
John Lee Olinger (Ph.D. Thesis) 1969 304 p Avail: Univ. Microfilms: HC $13.75/Microfilm $3.90 Order No. 69-6001

The effects of an applied uniform AC and DC electric field on nucleate boiling heat transfer and the stability of the vapor film near the minimum heat flux were investigated. The system used consisted of a flat plate conduction type heated surface facing upward. Visual as well as measurable effects of the applied uniform electric field were obtained. Electric field effects on the heat transfer were obtained for electric field intensity values in the range from 500 to 2,000 volts/inch for water and from 2,000 to 11,200 volts/inch for Freon-112. Results demonstrate that in the range of applied electric fields studied with water, the heat transfer in nucleate boiling was significantly affected by application of a DC field but not an AC field, whereas significant effects from both AC and DC fields resulted during film boiling. With water the effect of the DC electric field was polarity dependent, and the DC amperage was an important factor on the DC electric field heat transfer result. In the electric fields studied with Freon-112, neither an AC nor DC electric field affected the heat transfer in nucleate boiling, but both AC and DC electric fields affected the heat transfer in film boiling with the effects being considerably less than in the water work. Dissert. Abstr.

N70-18054# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
BOILING CURVE MEASUREMENTS FROM A CONTROLLED HEAT TRANSFER PROCESS
W. C. Peterson and M. G. Zaalouk [1969] 20 p refs
(Contract AT(40-1)-3939)
Avail: Issuing Activity

Feedback was introduced around a boiling heat transfer process in such a way that stable operation of the process was obtained in all boiling regions including the transition region. This system makes it possible to obtain much information concerning both the steady state and dynamic characteristics of boiling heat transfer processes. Pool boiling data obtained by the use of the system are presented. Accurate measurements of heater voltage and current were obtained by a technique involving the use of digital instruments. These data are presented in the form of plotted experimental points in the nucleate, transition, and film boiling regions. Values of n are determined for all three boiling regions. The ambient liquid is distilled water maintained at saturation temperature under atmospheric pressure. Author

N70-18063 Michigan State Univ., East Lansing.
TRANSIENT HEAT TRANSFER BY SIMULTANEOUS CONDUCTION AND RADIATION IN ABSORBING, EMITTING AND SCATTERING MEDIUM
Abou-Bakr Soliman Hazzah (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-5878

Various differential methods of approximating the exact radiative energy flux by the gradient of mean intensity are discussed. While this approximation is generally satisfactory, it does not yield an asymptotically correct heat flux at the optically thin limit. Solutions for the limiting cases of radiation predominant and conduction predominant are obtained for the steady state system by using singular and regular perturbation techniques. The problem is formulated in terms of a nonlinear fourth order differential equation. The complexity of the analysis for the conventional exact integral formulation has been tremendously reduced by introducing the

exact differential formulation. The differential formulation has also been found to yield itself more readily to the different limiting and special cases. The numerical results are obtained by using an implicit finite difference method. The temperature distributions and heat transfer rates are evaluated and compared with the steady state results. Dissert. Abstr.

N70-18071 Iowa State Univ. of Science and Technology, Ames.
HEREDITARY MATERIALS WITH LOCAL STRUCTURE
Tsu-Jiunn Peng (Ph.D. Thesis) 1968 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-9883

The theory of thermomechanical behavior of viscoelastic materials with couple stress is developed by making use of the fundamental concepts of continuum mechanics and irreversible thermodynamics. It is shown that, under conditions of arbitrary temperal and spatial variation of the temperature field, the stress tensor, the couple-stress tensor and the entropy density are derivable. Under isothermal conditions, it is found that four relaxation functions are needed to describe the mechanical behavior of an isotropic viscoelastic material with couple-stresses in a small deformation field, as opposed to two relaxation functions which describe the mechanical behavior of a classical isotropic viscoelastic material. The explicit forms of the linear thermomechanical constitutive equations with couple-stresses under time varying, spatially inhomogeneous temperature field are derived. Dissert. Abstr.

N70-18128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF SHORT LENGTH TURBOJET COMBUSTOR INSENSITIVE TO RADIAL DISTORTION OF INLET AIRFLOW
Francis M. Humenik Washington Feb. 1970 39 p refs
(NASA-TN-D-5570; E-5176) Avail: CFSTI CSCL 20M

An annular turbojet combustor was designed to be insensitive to shifts in the radial velocity profile at the compressor outlet. No airflow was introduced into the combustor through the inner liner wall except for a small amount required for cooling. Thus, no large shifts in airflow between outer and inner liners could occur as a result of inlet velocity profile shifts. Also, scoops were added to the air entry ports on the outer liner. These scoops extended completely across the passage which carried the air to be admitted through the outer liner. Thus, each scoop captured the correct amount of air regardless of changes in the radial velocity profile near the air entry port it covered. Tests were conducted to evaluate the concept. A rectangular segment apparatus was used. Test conditions were atmospheric pressure, 600°F inlet air temperature, and combustor average exit temperatures up to 2200° F. Obstructions were installed in the inlet duct to produce the desired distortions of the inlet radial velocity profile. The fuel used was ASTM A-1. The tests showed that the temperature profile at the combustor exit was largely unaffected by severe shifts in the inlet radial velocity profile. In addition, the pattern factor obtained was low for a combustor of such short length. Author

N70-18143# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
THE TEMPERATURE DROP IN THE CROSS SECTION OF A WALL DURING COOLING BY SWEATING [GRADIENT DE TEMPERATURE DANS L'EPAISSEUR D'UNE PAROI REFROIDIE PAR SUDATION]
V. I. Voronine and A. N. Glouchakov [1969] 22 p refs In FRENCH and RUSSIAN *Its* Trans. of Higher Educational Inst. No. 5
(LRBA-69-1211) Avail: CFSTI

The problem of nonstationary heating of plate of finite thickness is studied for the case when a coolant is constantly discharged through the pores. This permits the solution of the differential equation for the thermal balance using the method of separation of the variables. The case of a discharge which varies according to time is of great interest since the viscosity of the coolant can significantly vary with a change in the temperature. An approximate solution to the problem of nonstationary heating of a wall during porous cooling is obtained for the case when the discharge of the coolant is variable. This method can also be used when solving other problems concerning the cooling of porous bodies. Transl. by H.W.

N70-18147 Oklahoma Univ., Norman.
HEAT TRANSFER TO POOL BOILING MERCURY FROM HORIZONTAL CYLINDRICAL HEATERS AT FLUXES UP TO BURNOUT
Jerry Brent Turner (Ph.D. Thesis) 1968 375 p
Avail: Univ. Microfilms: HC $16.90/Microfilm $4.80 Order No. 69-5220

In 47 experimental mercury boiling runs, only one determination was made which might be justifiably termed burnout. The burnout was observed at a flux level of 1,018,000 Btu/hr sq ft, and was indicated by an instantaneous temperature rise in the heater considerably in excess of 400 deg F. During this and other runs, temperature excursions up to 250 deg F were observed in the heater. Boiling curves for mercury were obtained over a pressure range from 1 mm mercury to 1143 mm mercury, using two test heaters. It was observed that for any particular system pressure, a flux level was reached where the slope of the boiling curve decreased significantly so that subsequent increases in flux were accompanied by large increases in Delta T. The flux level at which the pronounced decrease in slope occurred, was termed the "departure flux." Departure fluxes were found to exhibit a maximum at system pressures below 25 mm mercury. Higher departure fluxes were obtained for increased pool depth. Dissert. Abstr.

N70-18154 Missouri Univ., Kansas City.
A STATISTICAL-THERMODYNAMICAL MODEL FOR LIQUID WATER
Arthur Connaught Brett (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-7225

A quantitative statistical thermodynamical model has been devised for pure liquid water with the ordinary isotopic distribution under atmospheric pressure in the 0 to 100 C. temperature range. This model has been based on experimental data available in the recent literature which indicate that there exist two different kinds of molecules in liquid water. One of these varieties of molecules resides on a short-lived lattice structure with short-ranged tetrahedral order. The other species occupies the interstitial cavities of the lattice. Expressions for the Helmholtz free energy and the isochoric heat capacity have been derived from an equation for the internal energy which contains a contribution from each of the two species of molecules comprising the system, each of these contributions being weighted with the mole fraction of the kind of molecule it represents. Dissert. Abstr.

N70-18195 Rensselaer Polytechnic Inst., Troy, N.Y.
A NONLINEAR STABILITY ANALYSIS OF THE FREEZING OF A DILUTE BINARY ALLOY
David Joseph Wollkind (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-6481

An investigation is made of the stability of the shape of a moving planar interface between the liquid and solid phases in the freezing of a dilute binary alloy. A nonlinear model is used to describe an experimental situation in which solidification is controlled so that the mean position of the interface moves with constant speed. The model postulates two dimensional diffusion of solute and heat. It is found that the interface can be unstable to finite amplitude disturbances even when linear stability theory predicts stability to infinitesimal disturbances. Further, cellular structure can be anticipated for certain ranges of parameter values. These results are in accord with relevant experimental evidence. Dissert. Abstr.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-16938*# Washington Univ., St. Louis, Mo. Dept. of Economics.
THE FEDERAL GOVERNMENT AND THE STATES: THE POST VIETNAM OUTLOOK
Murray L. Weidenbaum Dec. 1968 13 p Presented at the Natl. Conf. of State Legislative Leaders, Honolulu, 6 Dec. 1968
(Grant NGR-26-008-003)
Avail: CFSTI CSCL 05C

This study deals with the financial interrelationships between Federal programs and state governments. It is hoped that the information contained in it will be useful for policy-makers concerned with the role of the national space program in a post-Vietnam context. Author

N70-17026*# National Aeronautics and Space Administration, Washington, D.C. Scientific and Technical Information Div.
PROCEEDINGS OF THE WINTER STUDY ON USES OF MANNED SPACE FLIGHT, 1975–1985. VOLUME 2: APPENDIXES
1969 177 p refs Conf. held at La Jolla, California, 6–9 Dec. 1968
(NASA-SP-196-Vol-2) Avail: CFSTI CSCL 22A

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6. EARTH SCIENCES AND APPLICATIONS, APPENDIX F G. J. F. MacDonald, J. Whinnery, W. Thompson, and G. T. Orrok p 85–109 refs (See N70-17032 06-34)

7. LIFE SCIENCES, APPENDIX G G. Zuiderna, A. N. Kontaratos, and D. B. Hoffman p 111–162 refs (See N70-17033 06-04)

8. MATERIALS SCIENCE AND PROCESSING IN SPACE, APPENDIX H W. G. Shepherd and A. R. Vernon p 163–173 refs (See N70-17034 06-15)

N70-17032*# National Aeronautics and Space Administration, Washington, D.C.
EARTH SCIENCES AND APPLICATIONS, APPENDIX F
Gordon J. F. MacDonald, John Whinnery, William Thompson, and G. T. Orrok *In its* Proc. of the Winter Study on Uses of Manned Space-Flight, 1975–1985 1969 p 85–109 refs (See N70-17026 06-34)
Avail: CFSTI CSCL 03B

The accomplishments, objectives, and requirements of an earth science program are presented. The objectives are stated as: (1) A more precise knowledge and understanding of man's environment on earth and the forces controlling it, for accurate short and long term forecasting, and eventual control of his environment. (2) A more precise knowledge, inventory, and use of the earth's resources, particularly those of the United States. (3) The extension of communications of all types to world-wide coverage. (4) The development and adoption of systems of navigation and traffic control to achieve safe, economical, and swift air and sea transportation at higher traffic densities. (5) The accurate location of geographic features. The accomplishments have been in communications, meteorology, and geodesy. The needs in Earth Sciences and application are seen to be in obtaining observational data in the heat budget of the earth surface and atmosphere for improving weather forecasting, and possible climate modification, in geology for earthquake prediction. F.O.S.

N70-17286# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
AUTOMATIC INFORMATIVE ABSTRACTING AND EXTRACTING Annual Report
L. L. Earl and H. R. Robison Mar. 1969 176 p refs
(Contract Nonr-4440(00))
(AD-696653; LMSC-M-21-69-1) Avail: CFSTI CSCL 5/2

An investigation was made concerning the development of automatic indexing, abstracting, and extracting systems. Basic investigations in English morphology, phonetics, and syntax have been pursued as necessary means to this end. Experimental indexing and extracting systems are being developed. Author (TAB)

N70-17406# European Space Vehicle Launcher Development Organization, Paris (France).
ELDO/ESRO TECHNICAL REVIEW, VOLUME 1, NUMBER 3
1969 147 p refs Prepared jointly with ESRO
Avail: CFSTI

CONTENTS:

1. THE OSCILLATORY MOTION OF THE MAGENTOPAUSE AND THE EARTH'S BOW SHOCK G. R. Smit (ESRIN) p 255–299 refs (See N70-17405 06-23)

2. DIGITAL DATA ACQUISITION SYSTEM AS ON-BOARD INSTRUMENTATION FOR SCIENTIFIC SATELLITES U. (Lab. Elettronici e Nucl.) p 301–336 (See N70-17406 06-09)

3. PROJECT DEVELOPMENT PLAN FOR THE HEOS-A2 SATELLITE R. C. L. Collette (ESRTC) p 337–362 (See N70-17407 06-31)

4. PERFORMANCE OPTIMISATION STUDY OF TWO STAGE SATELLITE LAUNCHING VEHICLES G. J. N. Smith (Hawker Siddeley Dyn. Ltd. Stevenage) p 363–383 refs (See N70-17408 06-31)

5. HIGH EFFICIENCY REFLECTING SURFACES FOR THE VACUUM ULTRAVIOLET B. Feuerbacher, B. Fitton and W. Steinmann (ESRTC) p 385–403 refs (See N70-17409 06-34)

N70-17483# European Space Research Organization, Paris (France.)
THE POSITION AND THE RESPONSIBILITY OF THE INTERNATIONAL SPACE ORGANIZATIONS IN THE CONVENTION RELATE TO THE LIABILITY FOR DAMAGES CAUSED BY THE LAUNCHING OF OBJECTS IN THE EXTRA ATMOSPHERIC SPACE [LA POSITION ET LA RESPONSABILITE DES ORGANIZATIONS INTERNATIONALES DE L'ESPACE DANS LA CONVENTION RELATIVE A LA RESPONSABILITE CONCERNANT LES DOMMAGES CAUSES PAR LE LANCEMENT D'OBJETS DANS L'ESPACE EXTRA-ATMOSPHERIQUE]
H. Kaltenecker and J. Arets 1969 6 p Presented at the 12th Colloq. of the Intern. Inst. of Space Law, Mar del Plata, Arg., 9-10 Oct. 1969 In FRENCH
Avail: CFSTI

The legal aspects of the responsibility of international space organizations for damage caused by launching objects into space is discussed. Some new topics are proposed in order that the Convention now being prepared should agree with the UN space treaty signed in 1967. ESRO

PUBLIC COLLECTIONS OF NASA DOCUMENTS

N70-17526*# Illinois Univ., Urbana.
COORDINATED SCIENCE LABORATORY Progress Report, Sep. 1968–Jun. 1969
1 Aug. 1969 379 p refs
(Contract NAS8-21442; Grant NSG-228-62; Contracts DAAB07-67-C-0199; JPL-952383 et al)
(NASA-CR-107806; AD-692196) Avail: CFSTI CSCL 09C

CONTENTS:

1. SURFACE STUDIES F. Propst, G. Ehrlich, G. Ayrault, J. Burkstrand, I. Cooper et al p 1–46 refs (See N70-17527 06-24)

2. APPLIED PHYSICS R. N. Peacock, G. E. Anner, R. Birtcher, W. P. Bleha, J. W. Culton et al p 47–84 refs (See N70-17528 06-26)

3. PLASMA PHYSICS M. Raether, H. Boehmer, D. Bollinger, J. Chang, K. Evans et al p 85–107 refs (See N70-17529 06-25)

4. RAREFIED GAS DYNAMICS S. M. Yen, B. L. Hicks, W. Chow, W. H. Chu, A. Nordsieck et al p 108–113 (See N70-17530 06-12)

5. HIGH-VOLTAGE BREAKDOWN E. M. Lyman, R. Allen, D. Alpert, T. C. Casale, S. Y. Ettinger et al p 114–122 refs (See N70-17531 06-09)

6. SPACE AND ATMOSPHERIC SCIENCES A. Cohen, D. H. Cooper, G. R. Karr, H. W. Knoebel, J. L. Myers et al p 123–147 refs (See N70-17532 06-30)

7. SEMICONDUCTOR PHYSICS W. D. Compton, B. Arora, D. E. Cullen, T. E. Jones, E. S. Johnson et al p 148–184 refs (See N70-17533 06-26)

8. COMPUTER H. G. Slottow, J. Bouknight, G. Crawford, L. Hedges, K. Kelley et al p 185–193 ref (See N70-17534 06-08)

9. PLASMA DISPLAY D. L. Bitzer, H. G. Slottow, W. Coates, R. Johnson, W. Petty et al p 194–225 ref (See N70-17535 06-08)

10. URBAN DEVELOPMENT J. Voss, J. Akin, J. Bouknight, W. Brown, D. Erbes, D. Hansen et al p 226–237 (See N70-17536 06-34)

11. INFORMATION SCIENCE R. T. Chien, R. B. Ash, L. Bahl, Y. Chang, D. Cooper et al p 238–258 refs (See N70-17537 06-08)

12. NETWORKS T. N. Trick, W. Mayeda, M. E. Mokari-Bolhassan, S. Toida, J. Vlach et al p 259–269 (See N70-17538 06-10)

13. CONTROL SYSTEMS J. B. Cruz, Jr., C. I. Chen, G. D'ans, J. Davis, J. E. Heller et al p 270–291 refs (See N70-17539 06-10)

14. SWITCHING SYSTEMS G. Metze, H. Finkelstein, T. Gaddess, J. Hayes, M. Paige et al p 292–295 refs (See N70-17540 06-10)

15. COGNITIVE MEMORY H. von Foerster, R. T. Chien, P. Arnold, K. Bise, B. Carse et al p 296–336 refs (See N70-17541 06-08)

16. SEISMIC VEHICLE DETECTION B. D. Kirkwood, H. W. Knoebel, J. Gooch, and V. C. Meteze p 337–345 (See N70-17542 06-07)

17. ENGINEERING AIDS FOR THE HANDICAPPED H. W. Knoebel, J. G. Burr, and G. Stupp p 346–348 ref (See N70-17543 06-05)

18. PHOTOCHROMIC MEMORY FOR COMPUTER APPLICATIONS H. Knoebel, W. D. Compton, V. Krone and J. Burt p 349–351 refs (See N70-17544 06-08)

N70-17536*# Illinois Univ., Urbana.
URBAN DEVELOPMENT
J. Voss, J. Akin, J. Bouknight, W. Brown, D. Erbes, D. Hansen et al *In its* Coordinated Sci. Lab. 1 Aug. 1969 p 226–237 (See N70-17526 06-34)
Avail: CFSTI CSCL 13B

An in depth study of the factors causing the growth and decay of Kankakee, Illinois was started. During this first phase of the study, data were collected and prepared for computer display on the location, price, and date of real estate transactions throughout the Kankakee metropolitan area. Plans for the analysis of these data are described. Author

N70-17745 Comite National Francais de Geodessie et Geophysique, Rueil-Malmaison. Section d'Hydrologie Scientifique.
APPLICATIONS OF DISCHARGE AND WATER-LEVEL FORECASTS
L. Serra *In its* Proc. of Symp. on Hydrol. Forecasting 1969 p 211–219 (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Applications of discharge and water-level forecast, taking into account economic aspects and present day possibilities, are discussed. The management of reservoirs for hydroelectric purposes, water supply to agricultural, industrial, and domestic users, and flood control is also considered. ESRO

N70-17746 Civil Defence Organization, Sydney (Australia).
FLOOD WARNINGS: THE ROLE OF THE NEW SOUTH WALES CIVIL DEFENCE ORGANIZATION
I. N. Dougherty *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 220–226 (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

The organization and role of the Civil Defence Organization of New South Wales (Australia) in flood forecasting and warning are described. ESRO

N70-17747 Department of Works, Canberra (Australia).
FLOOD FORECASTING AND CONTROL OF THE LEVEL OF LAKE BURLEY GRIFFIN
B. J. Fitzgerald *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 227–241 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Lake Burley Griffin is an artificial lake for ornamental and recreational purposes in the heart of Canberra (Australia). The network of telemetering stations is described, as well as the flood-warning time provided by these stations; the methods of determining flood flow rates; operational procedures for controlling the lake-level by release of flood flows through the Scrivener Dam flood gates; procedures for ensuring public safety and minimizing flood damage both upstream and downstream of Scrivener Dam; and the degree of control of the lake water-level that should be practicable. With this network, it is practicable to pass floods of up to 30,000 cusec through the lake and still maintain the level in its central basin to within a few inches of normal ESRO

N70-17748 Brisbane City Council (Australia).
THE OPERATION OF SOMERSET DAM: A MULTI-PURPOSE PROJECT
G. Cossins *In* WMO Proc. of Symp. on Hydrol. Forecasting 1969 p 242–260 refs (See N70-17726 06-20)
Copyright. Avail: WMO, Geneva

Somerset Dam is a multi-purpose project. It provides 50% of the headworks storage for the Brisbane water supply system and is also operated to achieve a significant degree of flood mitigation in the lower Brisbane Valley and in the City of Brisbane (Australia). Hydroelectric power generation and irrigation are minor functions of this project. The operation of the water-level control is outlined, and proposals to install and automatic radio flood warning system with rainfall and river-height stations, etc. are described. ESRO

N70-17908# Defence Research Board, Ottawa (Ontario).
DEFENCE RESEARCH BOARD OF CANADA REVIEW 68
[1969] 118 p refs
(DR-197) Avail: CFSTI

Administrative and technical activities at the Defence Research

Board headquarters and at its eight regional establishments are reviewed. Listings of scientific and technical publications resulting from the research are included. D.L.G.

N70-17943 CIT Leasing Corp., New York.
FINANCING AND LEASING: TODAY AND TOMORROW
Donald G. Lindsay *In* Soc. of Plastic Engr., Inc. Custom and Captive Molding 1969 p 94 – 99 (See N70-17926 06-15)
Copyright. Avail: Issuing Activity

Methods of financing plant growth are discussed. Included in these are: debt financing, equity financing, and leasing which is recommended for the custom molding industry. F.O.S.

N70-18016# Council for Scientific and Industrial Research, Pretoria (South Africa).
REVIEW OF THE ACTIVITIES OF THE CSIR Annual Report, 1 Jan. – 31 Dec. 1968
1969 120 p refs
(AR-24) Avail: CFSTI

Reviewed research activities are related to the various problems affecting the Republic of South Africa as a whole as well as its industry and community. Emphasis is placed on such environmental factors as air and water pollution, public health, housing, etc., as well as the utilization of manpower. Especially outlined is progress made in purification of sewage to supplement water supplies and the establishment of research centers to study diet effects on cardiovascular diseases and personnel selection methods. G.G.

N70-18280# Library of Congress, Washington, D.C. Environmental Policy Div.
ENVIRONMENTAL SCIENCE CENTERS AT INSTITUTIONS OF HIGHER EDUCATION
Maria H. Grimes Washington GPO 93 p refs Presented to the Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., by the Subcomm. on Sci., Res., and Develop., 15 Dec. 1969 Prepared for Congr. House. Comm. on Sci. and Astronaut. *Its* Ser. H
Avail: Subcomm. on Sci., Res., and Develop.

The current interdisciplinary programs in colleges and universities which fall under environmental science centers were surveyed to gain a perspective on the future production of manpower, and knowledge to guide the Congress in fostering these programs. Questionnaires on environmental science centers were sent to 1300 accredited colleges and universities for the survey. The findings are classified and discussed by these categories: structure and composition, function, and funding. Copies of the surveys are included. F.O.S.

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— NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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